METAL INDUSTRY

ELECTRO-PLATERS REVIEW
BRASS FOUNDER AND FINISHER
COPPER AND BRASS
ALUMINUM WORLD

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METAL INDUSTRY

With Which Are Incorporated
COPPER and BRASS
BRASS FOUNDER and FINISHER
ALUMINUM WORLD
ELECTRO-PLATERS' REVIEW
PLATERS' GUIDE
with which is combined
BRASS WORLD

"From Ingot to Finished Product"

Founded January, 1903 by
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1868-1935

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Managing Editor

PALMER H. LANGDON
Assistant Editor

THOMAS A. TRUMBOUR
Business Manager

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VOL. 35 NEW YORK, JANUARY, 1937 No. 1

How Fares Our Land?

AT this time last year we ventured the prediction that the stars were favorable to those who were prepared to move forward with the new times. That prophecy has been fulfilled.

So now, after a year of revival, a year in which our hopes were crowned with some measure of success, a year of visible rewards for past efforts in the face of desperate odds, we may relax for a moment and look back over the hills we have climbed to see "how fares our land."

"Our Land" embraces the manufacture of non-ferrous metal articles and the coating and finishing of all metal articles—"From Ingot to Finished Product." It is broad and it is deep. It covers working of Copper, Zinc, Tin, Lead, Aluminum, Nickel, Gold, Silver, Platinum and a host of minor and rare metals. It includes the operations and manufacturing methods of the Foundry, the Rolling Mill, the Machine Shop, the Stamping and Spinning Shop, the Assembling Shop, Electroplating, Hot Dip Coating, Grinding, Polishing, Lacquering and Enameling. Its products range in size from pins and buttons to dirigibles and streamlined trains; varied in finish from the bare crude metal to the most highly polished and decoratively colored jewelry.

With a field of such breadth and depth, of such infinite variety, we must periodically stop and take stock, or we lose track completely. For that reason we devote this issue—January—to an Annual Review.

But how shall we review such a heterogeneous, kaleidoscopic field? What rule can we apply? What yardstick?

Of rules and yardsticks we have so many that we have none. Statistics are so few and incomplete that they are often misleading. Specialties are so diverse that conditions in one have almost no relation to the others. So we must fall back on the oldest and in some ways the most reliable source of information—Authoritative Opinion.

And that, in a word, is our Annual Review. It is a collection of Authoritative Opinions, a Symposium by men, each an outstanding leader in his own bailiwick. Every one of them is human. None of them is infallible. None of them is perfect. But every one has achieved eminence by long years of hard service, of unflagging labor, of honest achievement. And for that reason every opinion is careful, well-considered and accurate—written by one who knows his subject.

We commend this Annual Review Symposium to our readers.

FEATURES OF THIS ISSUE

The Record of the Metal Industries in 1936

A Year of Recovery in Business, and Progress in Technical Methods and Materials in the Manufacturing and Finishing of Metal Products.

BY A GROUP OF OUTSTANDING EXPERTS

The Primary Metals

COPPER BASE ALLOYS

By Dr. D. K. CRAMPTON

Director of Research, Chase Brass & Copper Co., Waterbury, Conn.

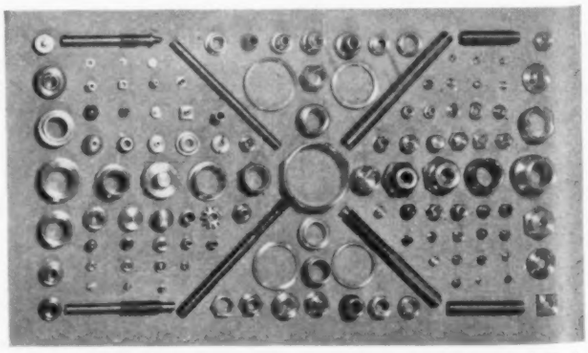
COPPER alloys are proverbially resistant to corrosion under widely varying conditions, and although most service requirements tend to become more severe, certain new alloys and modifications of the old ones have at least kept pace with such changes. There is perhaps no use where corrosion is more important than in the condenser tube field, and here much progress has been made in recent years. There is noted a distinct trend toward the cupro-nickel and various aluminum-brass tubes, but along with that there has been considerable improvement in the older and more standardized alloys. For instance, it has now been demonstrated that very small amounts of antimony added to the general range of yellow brasses is markedly effective in preventing dezincification. Further, the addition of this element does not lead to other types of attack as is frequently the case when other elements are used to combat dezincification. Another very recent development in condenser tubes is the duplex tube, particularly for application in the oil industry where aqueous corrosion is encountered on one tube surface and oil or vapor corrosion on the other. These two types of attack are fundamentally different and no single alloy has yet been found well suited to both. The duplex tube appears to be a decided improvement.

There continues to be increased use of such high strength structural alloys as the silicon bronzes and beryllium bronze. The former are finding a very wide application for many uses. Two of the more interesting are tanks of welded construction and wire for fourdrinier screens. The beryllium copper alloys are still quite expensive but their use is slowly extending. There have been numerous developments in modifications of these whereby other elements are substituted for a portion of the beryllium, effecting a considerable saving in cost with little or no sacrifice in physical or mechanical properties.

Considerable activity in patenting of precipitation hardening type copper base alloys is noted but to date commercial application of these has lagged. The expectancy is that logical fields of application will be found where advantage can be taken of the properties such materials possess.

Tellurium and selenium have been found quite effective for improving machinability of many copper alloys. The indications are that in certain fields they will be found more desirable than lead which has been so long and extensively used for this purpose.

A very greatly increased use of extruded bronzes and nickel silver in a wide variety of shapes for architectural trim is evident. The alloys used have not greatly changed but the tendency is distinctly toward more complicated designs, generally thinner sections and higher surface finish.



Courtesy, Copper & Brass Research Assn., New York

Typical screw machine products made of brass, and other copper alloys including the silicon bronzes. Multiple operations at higher speeds are readily accomplished on free-cutting brass rods.

In mill processes many improvements have been made. These are in the line of improved efficiency and increased capacity of production machines and generally higher rolling, drawing and extrusion speeds. A great deal of energy is being directed to the newer casting methods for making strip between slowly rotating rolls and for withdrawing solid sections through dies direct from the melt. While it cannot be said that these processes are really perfected, the indications are that a wider commercial application is approaching.

BRASS AND COPPER ALLOYS

By W. R. HIBBARD
Assistant Metallurgist,
The American Brass Co.,
Waterbury, Conn.

THERE have been no outstanding developments in the brass and copper industry during 1936.

New and heavier equipment has been installed by some manufacturers to meet the demands of their customers for longer and heavier coils of tubes, strip or wire. Several tube extrusion machines have been placed in operation during the past year.

Additional studies of annealing in controlled atmosphere has resulted in the installation of new equipment for these operations. These furnaces are usually designed to give more uniform anneals and to lower cleaning costs.

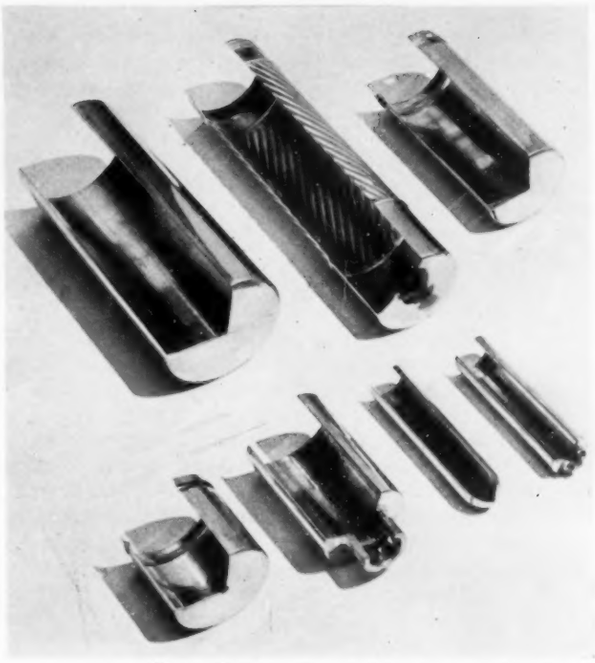
The year has shown increased use of the copper-silicon alloys where the corrosion resistant properties of copper and the strength of mild steel are desired. They are easily fabricated and are welded by all the common methods.

The heat treatable alloys such as beryllium-copper, are finding increased uses. Other such alloys are those containing copper, nickel and aluminum, copper and chromium and copper, chromium and silicon. The first is used for its resistance to the action of corroding agents, while the last two are used where strength and good electrical conductivity is required at elevated temperatures. Their principal uses are for welding tips and discs.

USES FOR ZINC

By W. M. PEIRCE
Assistant Chief,
Research Division, The
New Jersey Zinc
Company, Palmerton,
Pennsylvania.

THE use of zinc for coating steel; that is, in galvanizing, has for many years been the largest single use of metallic zinc. New developments in this field were conspicuously absent until very recent years. A year ago, in this review, attention was called to the sharp increase of in both electrodeposited and hot dip zinc coatings. Activity in this field has been even greater during the past 12 months. Patents relating to new methods of hot galvanizing have been issued and news is current of developments in hot galvanizing practice which may ultimately prove to be of definite importance. Much is also heard of further development along several lines in the electrogalvanizing field. The aim in both hot galvanizing and electrogalvanizing fields is, of course, to produce heavier coatings which are ductile, adherent, and uniform in thickness over the area coated. The final result is pretty certain to give the consumer better galvanized material by whatever process it may be produced.



Photo, Courtesy New Jersey Zinc Co., New York

Interesting shapes impact extruded from rolled zinc pellets. The fluted can and the bullet-shaped one below it are flashlight cases. The others are condenser cases for radio assemblies. Manufactured by the General Extrusion Co., Hillside, N. J.

One galvanized product in which a definite trend toward improvement appears to have started is galvanized screen cloth. Staining of paint by screens has long been a source of annoyance to the user. A heavily galvanized cloth promises to go a long way toward the solution of the problem, and such a product is now being extensively tested.

In the field of rolled zinc, the trend which had become evident a year ago toward the increasing use of copper-hardened rolled zinc for fabricating small sheet metal parts has continued and this material is becoming definitely more competitive with other metals in fields outside its traditional uses in dry cells, weatherstrip, jar tops, and name plates.

The use of Special High Grade Zinc in the die casting field continues to present the most spectacular developments among the uses of metallic zinc. 1936

saw a 30 per cent increase in the use of Special High Grade Zinc for use in die castings. Faster and more fully automatic die casting machines have extended the field of very small zinc alloy die castings while larger machines, some of them capable of holding a die 48 inches square, have made possible even larger and heavier die castings. Many new applications are for mass production and involve very large numbers of each part, but the increasing economies made possible by accumulated experience and skill in the application of die castings has increased the number of uses where a very small number of very complicated parts are required.

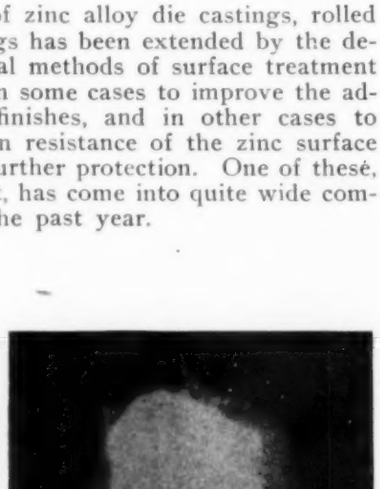
Zinc alloy die castings have become important in the production of domestic oil burners and radios. Their use in scientific instruments is an index of the increasing recognition of their reliability. A revival of new development in the vending machine industry has called for many new zinc die castings in both the housings and frames and in the mechanisms. Increased use in toy manufacture and in the automotive field have been striking.

The applicability of zinc alloy die castings, rolled zinc, and zinc coatings has been extended by the development of chemical methods of surface treatment which are designed in some cases to improve the adherence of organic finishes, and in other cases to increase the corrosion resistance of the zinc surface when used without further protection. One of these, the Cronak treatment, has come into quite wide commercial use during the past year.

USES OF CADMIUM

By GUSTAF SODERBERG

Technical Director, The Udylite Co., Detroit, Mich.



DURING 1935 a new use for cadmium was found in automotive bearings containing more than 95% cadmium. This upset the cadmium market completely, causing a severe shortage and a sharp rise in the price.

The plating industry which theretofore had taken the largest part of the output was particularly hard hit and several large firms doing cadmium plating but not requiring a particularly bright finish were forced to go to zinc plating. It was only with the greatest difficulty that the cadmium suppliers could keep their remaining customers in production.

1936 has seen a partial improvement in these conditions. The number of companies using cadmium bearings has decreased. A couple of smelters have started making cadmium and their production is expected to increase. The higher price has also made it possible to import cadmium. While the final figures are not yet known, it is evident that more cadmium was produced and consumed in 1936 than ever before.

While this improvement has been partly offset by increased use of cadmium in other industries, especially the paint industry which uses cadmium sulphide pigments, it has made it possible to improve deliveries to customers and even to take care of some people who went to zinc in 1935 but who for various reasons desired to return to cadmium.

The use of cadmium plating specifications centering around minimum thickness requirements is continuing to increase.

Several new cadmium plating developments are known to the writer, but these are being shelved until more metal becomes available.

The price of cadmium has stayed constant through the year at $1.05 per pound.

USES OF TIN

By Dr. D. J. MACNAUGHTAN

Director, International Tin Research and Development Council, London, England.

THE year 1936 has witnessed progress in some of the advances to which reference was made in an article, published last year in the January issue of this journal, on general developments in the tin-consuming industries.

Simultaneously, new knowledge has been acquired as a result of the continued researches of the International Tin Research and Development Council. These have resulted in numerous publications during the year, especially on the factors influencing the porosity and corrosion of tinplate, the fundamental properties of tin and its alloys, the constitution of tin-rich alloy systems, the detection and determination of tin by chemical and spectrographic analysis, the hot tinning of copper, and the properties of vitreous enamels opacified with tin oxide. A recent publication describes the anodic treatment of tin and tin-base alloys in a hot solution of alkali phosphate to give a hard, black film on the tin surface. By stopping-off certain parts of the anode a pleasing contrast, well adapted to decorative treatment, is produced. The corrosion-resistant properties of the film are under investigation. A new alkaline detergent for tinned ware, consisting of sodium carbonate and

sodium sulphite, which has resulted from the Council's work, has undergone considerable expansion in its use particularly in the dairy and similar industries. The detergent properties of the alkaline solution are unimpaired, while the sodium sulphite removes oxygen from the solution and thus inhibits corrosion of the tinned surface by alkali.

The application of electrodeposits of bronze from alkaline baths is extending, particularly as an undercoat for chromium deposits. Recent improvements in the properties of tin-base bearing alloys, made by modifying the composition, are attracting the attention of engineers. The modified alloys are now being introduced in a number of U. S. automobile engines, and show promise of diminishing the substitution of tin-base alloys by other materials.

A considerable measure of the increased world consumption of tin during 1936 is due to expansion of the tinplate industry, which used 13 per cent more tin than in the previous year. Apart from innovations that are improving the quality of tinplate, of which considerations of space prevent discussion here, this increase is due largely to a considerable expansion of the canning industry, both in regard to a greater consumption of canned food and an increase in the number of products so packed. The canning of beer has grown rapidly in U. S. A. and is now making headway in Great Britain and on the Continent in Europe. In U. S. A. this has been followed by the canning of wine, and the near future promises similar developments for other beverages.

USES OF LEAD

By F. E. WORMSER

Secretary-Treasurer, Lead Industries Association, New York.

PERHAPS the most significant development in the use of metallic lead products during 1936 was the revived interest in the use of lead for various parts of the plumbing system, particularly service and waste lines, where lead is noted for its ability to withstand corrosive attacks, and its growing use in shower pans. On the outside of buildings, lead is being selected more and more as a roofing and flashing material of great merit.

Another development worth noting is the action of the Lead Industries Association in adopting a **Seal of Approval,** available to lead plumbing goods manufacturers whose products meet the Standards set up by the Association for lead pipe, lead traps and bends. The Standard goes into effect January 1, 1937. The Standard will act as a guide to consumers in helping them to obtain plumbing materials of standard quality.

On the Pacific Coast, a plant has been erected for production of a metallic lead paint. The product has a soft metallic appearance and the manufacturer claims that it can be used advantageously in painting structures where chemical corrosion from gases and fumes is particularly severe.

The consumption of lead-tin foil increased considerably in 1936, in part owing to the increased use of foil for wrapping cigars of all prices. Lead-tin foil is particularly good for this purpose as it is highly moisture and corrosion proof and not subject to attack from the alkaloids in the tobacco. This use promises to grow.

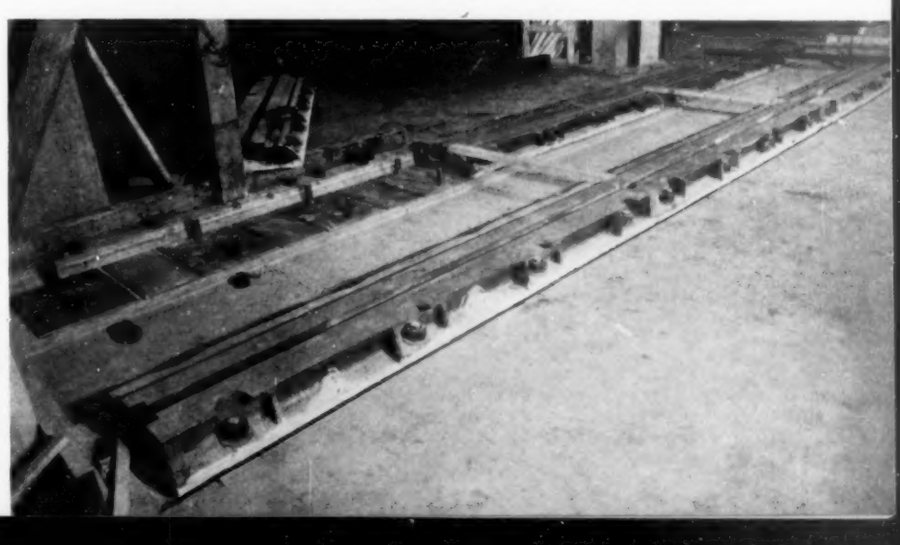
The telephone company has found that it can advantageously make loading-coil cases of lead rather than of ferrous metals.

Copper-lead and lead base anti-friction metals are finding increased application in automotive, diesel and other work. The technical press for 1936 is full of references to research findings in the bearing metal field which indicates that a large amount of experimental work is continually going on in this product.

Lead makes extraordinarily durable and beautiful cast ornaments and there is a growing call for it in that connection. It is far cheaper than bronze, does not stain, and gives a soft gray color which blends with most materials used in building. Lead articles are being produced at a cost low enough to make their selection on buildings of moderate cost well worth while.

One manufacturer has begun the production of extruded lead pipe by a modification of the bridge method, using a short core.

More and more chemical users are reporting very effective results from the use of tellurium lead, a comparatively new alloy for the chemical field. The demand for the alloy is growing as practical experience with it defines the place where it can best be used.



Lead-Asbestos Anti-Vibration Pads Under Rubber Mill Foundation

Photo, Courtesy Lead Industries Assn., New York

ALUMINUM METALLURGY

By E. H. DIX, JR.

Chief Metallurgist, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa.

MUCH of the advancement in the metallurgical knowledge of the aluminum industry has been of a fundamental nature and hardly lends itself to adequate presentation in a short review. Most of the developments of the past year have been chiefly in the line of improvements in manufacturing practices and were not, in themselves, very spectacular.

Several of the alloys introduced to the trade prior to 1936 have attained marked commercial success during this year. This is particularly true of the aluminum-magnesium-chromium alloy (52S), the aluminum-magnesium silicide-chromium alloy (53S) and the free-cutting alloy (11S). That the latter type alloy has considerable appeal appears to be well demonstrated by recent European efforts to develop materials of similar characteristics. It is also particularly gratifying to note the recent increased interest in the Alclad materials. These products definitely are not new developments, but their wider commercial acceptance certainly can be considered as an advancement of the past year.

Interest has also been manifested in light-weight structures and materials with high resistance to corrosion, shown by the symposia on these general subjects which were sponsored by four of the leading technical societies during the year. The attendance at these meetings was large and the papers and discussion presented indicated an active interest in the non-ferrous alloys.

In the realm of fundamental metallurgy, two recent contributions from the aluminum industry appear to supply significant additions to the common fund. One of these[1] represents a contribution toward a better explanation of the phenomenon of age-hardening. When the theory of precipitation hardening was first proposed it evoked much discussion in metallurgical circles but finally was fairly generally accepted, with certain reservations. One of the more important points in which the theory appeared to be weak was that no changes in the dimensions of the crystal lattice could be found during the initial period of aging. Several modifications of the basic theory therefore were proposed to allow for this apparent anomaly. More refined methods have now shown that precipitation does occur during the early stages of aging in age-hardenable aluminum-copper alloys (and also in aluminum-magnesium alloys), so that this point now appears to be satisfactorily explained. Since age-hardenable alloys are not limited to materials of aluminum base, the results of this investigation may prove of value in many of the non-ferrous industries.

The study of diffusion in solid metals also has been a subject of interest to metallurgists for a number of years. The results secured from an investigation of diffusion in certain aluminum alloys[2] appear to make a useful addition to the data available on this highly interesting subject, while a recently published review[3] of information on diffusion affords a summary of the numerous investigations which have been conducted.

[1] "Age-hardening of Aluminum Alloys. I—Aluminum-copper Alloy," W. L. Fink and D. W. Smith, Tech. Pub. No. 706, AIMME.

[2] "Diffusion of Mg and Si into Aluminum," H. R. Freche, Tech. Pub. No. 714, AIMME.

[3] "Diffusion in Solid Metals," R. F. Mehl, Tech. Pub. No. 726, AIMME.

THE ALUMINUM INDUSTRY

By S. K. COLBY

Vice-President, Aluminum Company of America, Pittsburgh, Pa.

SINCE aluminum has had its share in the increase in volume of consumption which has been general with all metals throughout 1936, a year-end summary may be of more interest if it points out a few of the newer applications of this versatile metal. Increased tonnage in the fields it already occupies fails to satisfy those who engage in the industry—they are constantly interested in and intrigued by new uses.

Aluminum was chosen as the metal best fitted for

Photo, Courtesy Aluminum Company of America, Pittsburgh, Pa.

The Pierce Arrow "Travelodge." This was the first stock-model aluminum-paneled trailer on the market; light weight combined with safety and sturdiness, and the beauty of the natural aluminum finish

the construction of an emergency bulkhead for a roller-gate dam at Gallipolis, Ohio. Each of the seven units of this bulkhead is 129 ft. long, 13 ft. wide, and 4 ft. 4 in. high, and although they weigh 28 tons apiece, they can be placed in position by a maneuver boat. Because of this fact, the usual crane and runway bridge to be found on roller-gate dams is dispensed with, effecting a great saving in dam construction.

The use of aluminum on dredge and dragline booms enables operators to speed the swing cycle and to employ larger buckets. The first aluminum dredge boom, and the longest in any metal, was recently placed in service. Its 240-ft. length is made up of 150 ft. of aluminum structural shapes, and 90 ft. of steel shapes. The new boom uses a 6-cu. yd. bucket instead of the 4-cu. yd. bucket which it would have been necessary to use had the entire boom been built of the heavier metal.

The floor system of the Stratford Avenue Bridge on the Boston Post Road in Bridgeport, Conn., was replaced with aluminum shapes and plate surfaced with mineralized asphalt plank. Aluminum bulkheads, 20½ ft. long by 9½ ft. high, will protect the windows of the Joseph Horne Company, in Pittsburgh, from damage by future floods. An aluminum pilot house was erected on a U. S. Army Engineer pusher boat. Rubbish trucks, transcontinental buses, brewery and milk storage tanks, have all been built of aluminum and placed in use during the past year.

Most unusual was the construction of a marsh buggy, built by an oil company for prospecting purposes in swampy land. This strange vehicle, largely made of aluminum, can travel on land and water by the aid of buoyant tires 10 ft. high.

Strength and lightness are not, of course, the only virtues of aluminum. Lighting the San Francisco-Oakland Bay Bridge has been achieved by the use of sodium vapor lamps and Alzak reflectors. Bright aluminum foil, which reflects heat as a mirror reflects light, has many new applications for insulating purposes. A notable example of this type of insulation is in the fifteen miles of steam lines at the Allegheny County Home, Woodville, Pennsylvania.

A recent survey of the utilization of aluminum by American industry shows its use in more than thirty major industries as widely different in characteristics as aircraft and textiles. Throughout the year, the approximate two thousand applications of aluminum have been considerably augmented. This brief summary names only a few of the more spectacular new applications.

NICKEL IN NON-FERROUS METALS

By ROBERT C. STANLEY

President, International Nickel Co. of Canada. Ltd., Copper Cliff, Ont.

STATISTICS for the first ten months of 1936 indicate that the current year will establish new records for the nickel industry in the volume and diversification of world consumption.

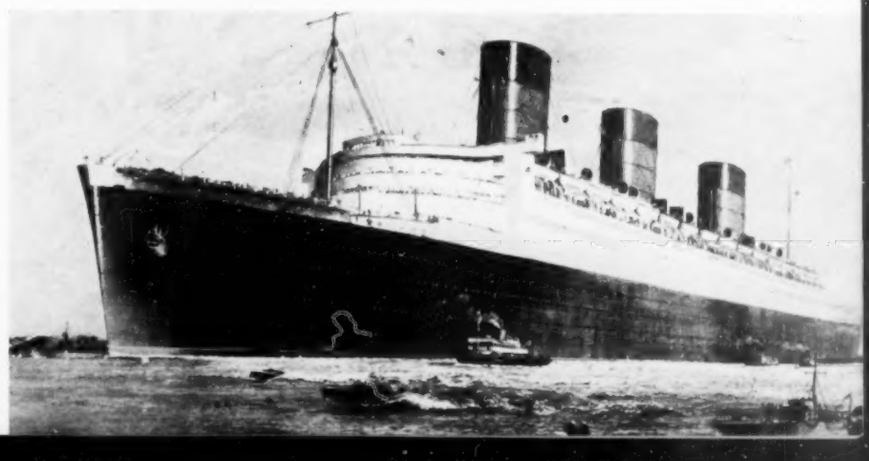
World consumption of nickel in all forms during the first ten months of this year attained a total of some 162,000,000 pounds, an increase of more than 20 per cent over the corresponding figure in 1935 which had established a new record for the industry. This current consumption compares with 112,000,000 pounds in the first ten months of 1929.

Transportation retained its position during 1936 as the dominant field of nickel consumption.

The increase of automotive production in Canada and United States for the first nine months of 1936 to 3,462,034 units as compared with 3,012,628 units in 1935 was reflected in the consumption of nickel in both nickel steels and non-ferrous metals, as the consumption of nickel per unit more than held its own. Passenger car trailers are developing into a volume industry which offers a market for Monel for galley sinks and wash basins.

Nickel and nickel alloys have benefited from the increase in railroad equipment buying. Monel and nickel-silver are standard materials for dining car kitchen equipment.

The use of 70-30 copper-nickel tubes in the con-



The Queen Mary uses huge quantities of non-ferrous metals including nickel and nickel-bearing alloys

densers of the Queen Mary is an outstanding example of the recognition being given this material for its resistance to sea water. Other alloys, either in wide use or coming into use in marine equipment are Monel; K Monel; 75 copper, 20 nickel, 5 zinc; Inconel, S Monel; pure nickel for nickel cladding.

In aviation the nickel alloys in use are Inconel, Monel, K Monel, Nickel-Aluminum and S Monel.

The communications industries continued to lean heavily on nickel for the fabrication of numerous devices, radio maintaining its position as the largest consumer in this field. Among the nickel alloys in use are nickel-aluminum-iron; Monel; nickel-copper; malleable nickel and nickel silver.

In the chemical industries Monel, nickel, nickel-clad steel, stainless steel, and practically the entire range of nickel alloys including nickel silvers, Ni-Resist and K Monel are used. The petroleum industry offers one of the broadest fields for demonstrating the usefulness of nickel in modern industrial processes, using pure nickel, Monel, Inconel, nickel clad steel and K Monel.

Construction of dams, bridges, roads and public works in general continued to draw heavily on nickel. Monel in various forms, nickel clad steel and other corrosion resistant alloys have found numerous specialized uses. An outlet for Monel is roofing, approximately half a million pounds having been used recently in New York City alone. The use of Monel tie wire for ceilings is growing.

Nickel and nickel alloys may now be said to be essential in the preparation of foods. They include a majority of the ferrous and non-ferrous nickel alloys from Ni-Resist and stainless steel on one hand to Monel and Inconel on the other, and also pure nickel, nickel plated and nickel clad materials, nickel silvers and 70-30 cupro-nickel.

The electrical industries continued to employ nickel, Monel, K Monel and nickel as essential materials for applications ranging from radio to power production.

Nickel alloys play an important role in the textile field, being used in the manufacture of rayon, in bleaching and dyeing and in laundering and dry cleaning. Agricultural machinery and equipment use, among other materials, nickel-aluminum alloys and 20 per cent nickel silver. The year has seen an increase in the use of nickel alloys by the pulp and paper industry.

The consumption of nickel alloys has kept step with the accelerated pace of home building and modernization. This trend is illustrated by the volume of Monel going into the household.

Monel has become a standard material in a wide number of miscellaneous industries including surgical instruments, optical instruments, tanning and sporting goods.

Establishment of standards in the control of quality and hardness of the nickel bars and rounds for "platers' bars" has contributed to a substantial increase in the amount of nickel going into this application. The platers' bars are bars of nickel upon which gold sheet is silver-soldered so that the whole may be cold worked to the thickness required for watch cases and bracelets, about one-thousandths of an inch or less. The same progress has marked the production of "cores," nickel wire to be covered with gold in a somewhat similar manner, for spectacle frames and jewelry.

Nickel plating has continued to move forward steadily. It is now recognized that a high grade of chromium plate cannot be produced without an appreciable underlay of nickel. Its consumption in plating is being stimulated still further by the growth of bright plating which is making substantial progress.

MAGNESIUM

By Dr. JOHN A. GANN

Chief Metallurgist, The Dow Chemical Company, Midland, Mich.

THE year 1936 has witnessed the fulfillment of earlier predictions that the applications of magnesium alloys as a material of construction were destined to become the most important use of this ultra-light metal. Although the consumption of magnesium castings and wrought products has been steadily increasing, other uses of the metal, such as metallurgical, chemical, and pyrotechnical, have occupied, up to the present time, the major portion of the picture. In 1936, however, the value of Dowmetal and magnesium alloy products will exceed the total value of the magnesium used for all other purposes.

Technical progress in the die casting of magnesium alloys has resulted in the large scale production and use of this class of castings. The old goose-neck machine has given way to modern, hydraulically operated, plunger-type machines, similar to those used in the brass industry. Measured quantities of metal are transferred from a melting pot to the receiving well of the machine. The plunger then forces the metal into the die cavity under pressures ranging from approximately 1,000 to 5,000 pounds per square inch. Many advantages accrue through the use of the newer machines and casting technique. The castings are sounder and freer from internal blows and porosity. The surface is smoother and substantially free from cold shuts, seams, and shrinks. Larger and more complicated castings can be produced. Sections can be thinner and webs and fins can be longer. The

New Hoover One Fifty Cleaning Ensemble, designed by Henry Dreyfuss. The One Fifty uses for the first time in household design, magnesium, the airplane metal, one third lighter than aluminum; in modern classic design, on the "teardrop" principle in blue and stratosphere grey

use of a separate melting pot results in better control of metal temperature and quality.

Magnesium alloy die castings have been used to a limited extent for some time. The year 1936, however, has witnessed a large increase in production due, primarily, to their use in the new Hoover-150 cleaner. After adopting Dowmetal for this machine, the Hoover company erected a new plant for the production, machining, and finishing of these die castings, which are now being produced at a rate of approximately 5,000 castings per day. Five different parts are made, namely, the main housing, bail, fan, chassis, and bottom plate. The main casting is probably the largest and most complicated magnesium alloy die casting commercially produced.

Progress has likewise been recorded in other fields. New applications which have become important during the past year include the use of sand cast Dowmetal in Foster-Wheeler ventilating fans in various sizes up to 12 foot diameter installations, with savings in weight over former construction amounting to from 165 to 1,100 pounds; and in the safety blocks used in die press work where weight savings amount to from 3 to 90 pounds per block. Rolled plate is likewise being used in increasing quantities for foundry match plates and for cope and drag boards.

In the metallurgical field, we find the development of a new wrought alloy that can be heat treated after it has been formed into shape. This alloy can be readily worked by extrusion and press forming operations. It has good corrosion resistance and in the heat treated condition possesses excellent mechanical properties. Improved yield strength is one of its more important characteristics, particularly from the standpoint of structural engineering.

PLATINUM AND THE PLATINUM METALS

By E. M. WISE

Assistant Manager, Research Laboratory, The International Nickel Company, Inc., Bayonne, N. J.

ONE of the most important new applications of platinum is for lining large reaction vessels employed in certain recently developed chemical processes where less noble metals are hopelessly inadequate. In other instances interest in platinum-clad base metals is due to the desire for higher purities where even the slight contamination arising from the use of the more corrosion resistant base metals is undesirable. Platinum-clad is also useful for electrodes in electrochemical processes and in electrodialysis. The corrosion resistance of platinum, the ease of fabrication and the low cost of refashioning all favor its use.

Platinum has no competitor in resisting slagging action at high temperatures and commercial use of this property is being made in the glass industry where rhodium-platinum is employed for lining glass nozzles employed in producing rods of glass of accurate diameter and for "spinnerets" for producing fine glass filaments which can be spun into flexible cloth and used for electrical and thermal insulation. This application has become commercially important and promises to grow rapidly.

The use of platinum metal alloys for rayon spinnerets is general and interest is being shown in alloys of higher platinum metal content.

The automotive industry is taking appreciable quantities of platinum and palladium alloys for electrical contacts in electric clocks and generator voltage regulators for automobiles and, in various instruments, and the high tension magnetos employed in aircraft.

Rhodium plate continues to find extensive use in the jewelry and allied fields and for surfacing electroformed reflectors. Methods have been devised for stripping rhodium from plated surfaces which avoid difficulties in refinishing. Ruthenium has been electrodeposited from a variety of baths and uses for this hard plate are developing.

Palladium leaf, beaten in a manner similar to that employed for gold leaf, has been applied to interior decoration. The "Iridium Room" of the St. Regis Hotel in New York, is a notable example. The use of palladium leaf in bookbinding may be noted, a recent example being the Webster Collegiate Dictionary which is lettered and edge "gilded" with this metal.

The use of palladium in dental alloys continues to grow and alloys containing considerable percentages of this element are now produced by practically all of the manufacturers of dental golds. The white color, high strength, corrosion resistance and moderate cost of these alloys has rendered them important. Interest is shown in the high platinum metal content alloys because of their high melting point and relative immunity to damage by high temperature treatments and considerable work is in progress on the casting and enameling of these high melting and extremely noble metals.

The use of platinum in jewelry has reflected the improvement in business conditions and the sale of diamond set jewelry, while the increase in the number of engagements and marriages has markedly increased the demand for platinum rings. It should be noted that the use of platinum for rings actually requires more platinum than all the other forms of jewelry. In some of the foreign countries the production of inexpensive platinum rings has been encouraged with the object of building up a platinum reserve to tide over emergency requirements of platinum for national defense.

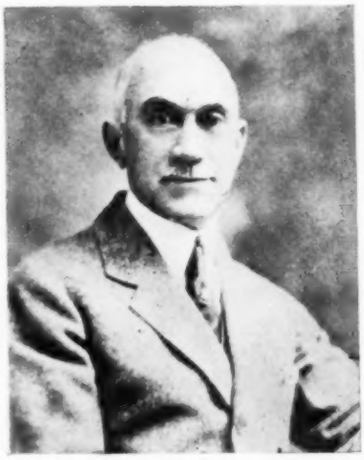
The price of platinum underwent a brief rise, partly due to speculation and to transient foreign requirements, but closed the year at a price only moderately above that prevailing during the early months. Production continues high and the Canadian copper nickel ores continue to provide the largest proportion of the platinum, palladium and rhodium. Research continues actively and substantial applications are being developed in a variety of industries where other metals prove inadequate.

Metal Manufactures — Products and Processes

THE INGOT METAL INDUSTRY

By Dr. G. H. CLAMER

President, The Ajax Metal Co., Philadelphia, Pa.



THE Non-Ferrous Ingot Metal Institute has continued work on the research project carried on at the Bureau of Standards and sponsored by the Institute. The work during the current year has been confined to a further study of the effect of certain impurities and groupings of impurities on the 85 copper, 5 tin, 5 lead, 5 zinc alloy, "Composition No. 1."

A group, comprising the metallurgists of the various units of the Non-Ferrous Ingot Metal Institute, has been organized and has held two meetings within the year. It is the purpose of this group to confer on metallurgical problems confronting the industry and to cooperate with the Bureau of Standards, and later with the American Society for Testing Materials, in developing standard methods for sampling and chemical analysis.

From the commercial standpoint, the sale of ingot metal has kept pace with the increase in production in all similar lines. Furthermore, there has been an established trend away from scrap and a return to the use of ingot on the part of those few foundries having resorted to this practice, supposedly as an economy measure, during the depression. There have also been many converts to the use of ingot metal among foundries which previously used the virgin elemental metals in making their alloys. These trends are no doubt due to the fact that the ingot industry in general is at present producing higher quality alloys than ever before and at price sufficiently below the cost of virgin metal mixtures to represent a decided economy.

The raw material of the industry consists of scrap brass, turnings, automobile radiators, scrap copper; in fact, copper bearing material of any kind that may be suitable, through scientifically correct melting and refining, for conversion into alloys of the proper quality. To pursue the correct and costly refining operation necessary entails the use of furnaces with large unit bath capacity. This is essential to preclude excessive per pound cost by reason of providing a sufficiently great tonnage divisor for the ensuing cost. Furnaces of small holding capacity, and particularly furnaces using crucibles, can be used only for melting. Refining operations are not economically possible on small unit charges. Small furnaces may be used, therefore, only for direct melting of scrap that is of uniform quality, such for example as yellow brass turnings and carefully sorted yellow brass solid scrap. For melting this particular class of material small electric furnaces are advantageous.

Crucible furnaces are used for making special alloys, largely from virgin metals, the selling price of which is above the cost of the virgin metal mixture. This class of ingot represents but a small part of the production of the non-ferrous ingot metal industry.

The above refers entirely to the alloys of copper base in ingot form. A number of the producers of copper base alloy ingots produce also various white metal alloys, including aluminum alloys. Such alloys also are made almost entirely from scrap and are sold as a rule at a differential below the cost of virgin.

Notwithstanding the 4c. duty in this country on copper and copper alloys, during a considerable portion of the current year copper has sold abroad at a price in excess of the prevailing price in this country. This, unfortunately, has led to the export of large amounts of scrap that normally would have been consumed in the home market, either by the ingot manufacturer or the custom smelter. Just what effect this large exportation of scrap will have on the future market is problematical. Of late the price of scrap has, therefore, followed not the domestic price for copper but the foreign price. Notwithstanding this situation the differential between the cost of ingot metal and virgin metal mixture cost has been upon a basis representing a spread greater than has previously prevailed. Naturally with the increase in cost of scrap as compared with virgin metal mixture cost this differential must necessarily become less. The use of ingot metal as now established is not based only on the saving effected as compared with new metal, but is largely upon the satisfactorily uniform results secured in the foundry by the use thereof.

INGOT METAL PROBLEMS

By the Technical Staff of H. Kramer & Co., Chicago, Ill.

ADVANCES made in ingot production, during the past year, as in many other lines, are simply the culmination within the year of research and development work that has been in progress the world over for a long time. Such work will continue to go on, not only along new lines, but in consolidation and substantiation of the results already obtained.

The type of progress is one which is constant and deliberate, rather than of a sporadic nature. No one man or company can claim absolute priority or right to its honor. Any advance today is the result of much thought and the work of many hands.

The ingot manufacturer in his effort to improve his product, economically is confronted by two general problems, apparently diverse in nature, but actually closely allied, namely: (1) the ever present increase in quantity and variety of impurities in scrap, and (2) new methods of handling, sorting and refining present day scrap.

The first problem is one that is common to the entire metallurgical field. The new alloys now being

made, containing varying amounts of special elements, such as chromium, titanium and vanadium, are gradually finding their way back into scrap, which presents new problems to the ingot producer. Metallic impurities, however, are but one phase in the problem, for the whole subject of deoxidation and degasification comes under this category. New trade "alloys" are being continually presented to metallurgists as a cure-all for their troubles. Experience has shown that they are for the most part only repetitions of products now on the market.

A review of the literature, patents and trade developments pertaining to the non-ferrous field shows that no new startling developments have taken place which can be applied to melting, refining, deoxidation or casting of ingots. Although new methods have been reported discovered while working on a laboratory scale, no elixir has been disclosed for commercial application.

The scrap problems of yesterday are still those of today, but an effort must be made not to purchase scrap on a commodity basis, but on the actual assay or chemical analysis. Payment must be made for the actual metal value contained and penalties imposed for badly contaminated scrap, which causes refining costs to soar.

Competition for scrap and higher wages have caused the ingot producer, generally, to look into his metallurgical processing cost for more economical operation and reduction of metal losses.

Much interest is shown in consumer's problems. It is recognized that foundry, metal and finishing problems must become a part of the producer's research program, if general improvement is to be affected. Closer cooperation between consumer and producer is noted.

INGOT METAL PRODUCTION

By W. A. SCHEUCH

Works Manager, Nassau Smelting & Refining Co., Tottenville, N. Y.

NORMAL progress in improvement of ingot metal manufacture continued throughout the year 1936 with no decided or outstanding changes in method. The use of ingot metal has been established during the past year with a number of foundries which formerly used primary metals only, and is being actively considered by others.

This successful invasion of the primary metal alloy foundry field is attributed to the improved quality and uniformity of present day ingot metal and to the improved color and surface condition of the finished castings. Chemical and metallurgical control has enabled producers to maintain closer limits on the alloying elements and to hold to a minimum the metallic impurities and non-metallic inclusions. The closer supervision of the melting and casting of the furnace heat has enabled the producers to make deliveries which are not only uniform within themselves, but duplicated in subsequent deliveries.

Investigation of the effect of metallic impurities in 85-5-5-5 red brass ingot metal, both individually and collectively, has been actively carried on at the Bureau of Standards under the sponsorship of the Non-Ferrous Ingot Metal Institute. A number of ingot manufacturers have carried on investigations on the physical properties of ingot metal in their Research Departments.

The American Society for Testing Materials in its 1936 Book has published Specifications B-30-36 covering twenty copper base alloys from the high tin bronzes to the high lead bearing alloys. This action changes the status of Tentative Specification B-30-32T to an accepted Specification.

Effort has been continued in 1936 to further reduce the large number of alloys in the red brass class. The Institute of British Foundrymen are considering a proposal by the Non-Ferrous Sub-Committee in June, 1936, to standardize on 3 alloys in place of some 37 alloys in the range copper 82-92%, tin 4-9%, lead 0-7%, and zinc 1-8%.

Special alloy ingots such as aluminum bronze, manganese bronze, and silicon bronze are being used in greater amounts for special purpose jobs. For example, manganese bronze with tensile strengths up to 120,000 pounds are being supplied to foundries.

With the present investigations being continued, progress in the production of high quality ingot metal should continue in 1937.

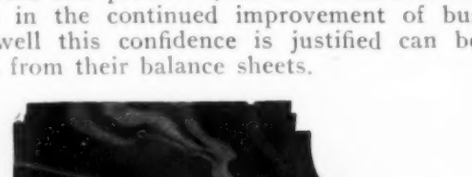
THE BRASS FOUNDRY

By WILLIAM J. REARDON

President, National Alloys Co., Detroit, Mich., Associate Editor, METAL INDUSTRY.

ENCOURAGED by the up-turn in business generally, production brass foundries have recognized the importance of factors affecting the future and have started making various improvements in methods,

equipment and processes, all of which indicate confidence in the continued improvement of business. How well this confidence is justified can best be judged from their balance sheets.



Photo, Courtesy H. Kramer & Co., Orange, Ill.

Metal moves from ladle to mold. A casting is born!

Brass foundry plants have not received the attention of inventors to any great extent, and there are therefore few radical changes in the molder's tools and appliances. Numerous ingenious devices for handling materials, however, have been developed. Such is a device for pouring metal which enables a man to convey the metal to the molding floor and also do the pouring and skimming; thus one man performs an operation which formerly required three men.

Sand conditions and their effects are being studied by both brass foundries and jobbing foundries. In the past most brass foundrymen thought it necessary merely to cut over the sand and riddle it with an electric riddle. They now find that an aeration machine will prepare an ideal sand for molding. It will increase the fluidity of the sand and thus help to produce smooth surface castings, thereby improving the quality of the castings and reducing costs through the elimination of pinholes and the excess bond and moisture which cause the majority of sand defects.

The condition of the jobbing foundry has not greatly improved. At best its business is hand-to-mouth production, always in a hurry. It is becoming virtually an emergency foundry. Unprecedented changes have occurred, particularly during the past year, and will probably continue to occur. Business is experiencing a change of sentiment in favor of steadier improvement with fewer fluctuations. The jobbing foundry has now realized that in order to exist it must do something to regain the business lost to the die casting and forging industry. A few years ago the plating industry was in a position like that in which the jobbing foundry now finds itself. The plating industry, by developing chrome plating, not only saved its business but increased it considerably. The jobbing foundry must recognize the necessity of giving more consideration to new methods and new alloys. There will always be work for the jobbing foundry if it gives the same attention to the discovery of new fields that other industries gave to means by which work was taken from the brass foundry.

We read from time to time in the trade journals of the progress made by the jobbing foundry in Europe. I now have in mind the 13 per cent silicon aluminum alloy, which was discovered by an American but which seems to be used far more in Europe than in the United States. With various modifications silicon aluminum alloy is used for airplane and Diesel engine parts and cylinder heads. English foundrymen assert that engineers will use this new alloy extensively if its virtues are brought to their attention. Our jobbing foundrymen seem not to have been so successful in this regard as the English. Our foundrymen have, however, developed aluminum bronze to a very high degree of efficiency and have induced its use for a wide variety of purposes. It is used in high pressure steam work and pump work with a degree of success that was considered impossible five years ago. For many years it had been thought that no alloy containing aluminum could withstand steam or water pressure; today it is common practice to use aluminum bronze in high pressure steam and water parts. Because of its remarkable resistance to the corrosive action of various chemicals, its strength, and its resistance to abrasive action, and because its coefficient of expansion is 50 per cent greater than steel, aluminum bronze is universally used in gasoline cracking and tar stills. It is also extensively employed in bearing guides for dies. It holds its size and is supplied in almost any degree of hardness from 100 up to 340 Brinell with a tensile strength equal to that of steel.

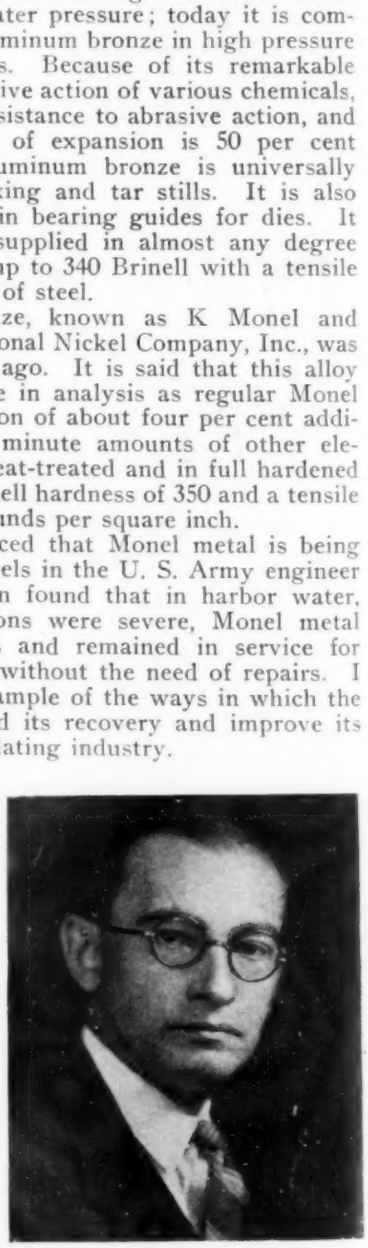
Another alloy bronze, known as K Monel and sponsored by International Nickel Company, Inc., was announced some time ago. It is said that this alloy is practically the same in analysis as regular Monel metal with the exception of about four per cent additional aluminum and minute amounts of other elements. It is readily heat-treated and in full hardened condition shows a Brinell hardness of 350 and a tensile strength of 160,000 pounds per square inch.

It has been announced that Monel metal is being used for propeller wheels in the U. S. Army engineer service, it having been found that in harbor water, where service conditions were severe, Monel metal gave excellent results and remained in service for more than four years without the need of repairs. I mention this as an example of the ways in which the brass foundry may aid its recovery and improve its condition as did the plating industry.

BRASS FOUNDRY PRACTICE

By H. M. ST. JOHN

Chief Metallurgist, Detroit Lubricator Co., Detroit, Mich., Associate Editor, METAL INDUSTRY.



THERE has been little change in brass foundry equipment or methods during 1936. The technical control of foundry operations, designed to

eliminate variables and thereby accomplish the double purpose of improving quality and decreasing costs, has made slow but steady progress. An increasing number of foundries have adopted modern methods of temperature control and there is even some prospect that the control of molding sand quality will receive more widespread consideration.

The various types of furnaces in general use have held their places in the industry without much loss or gain for any one type. The controversy with respect to furnace atmosphere has gone merrily on and is now occupying much space in British journals and transactions. The present state of the argument may briefly be stated as follows:

1. A strongly oxidizing atmosphere in the melting of foundry brasses and bronzes is undesirable.
2. A slightly oxidizing atmosphere will produce metal of top-notch quality. This is the most favorable atmosphere obtainable in fuel-fired furnaces. In electric furnaces some of their inherent advantage is lost due to an increase in their otherwise low metal loss and an increased operating cost in furnaces using graphite electrodes or oxidizing resistor elements.
3. Many electric-furnace users believe that a neutral atmosphere will yield metal of maximum quality at the lowest possible cost. The normal electric-furnace atmosphere, high in carbon monoxide, is oxidizing to some metals, neutral to most brass-foundry alloys, reducing to others.
4. An atmosphere definitely reducing to the metal being melted is undesirable and must be avoided.

The casting of brass and bronze in metal molds is marking time at a low production level, waiting for more economical mold materials.

New alloys have made great progress during the year, even though most of them have not yet come into general use. By precipitation heat-treatment of high-copper alloys containing suitable proportions of nickel with tin or silicon, splendid physical properties can be obtained, accompanied by good resistance to ordinary corrosion. The so-called silicon bronzes, containing 3 or 4% of silicon with small percentages of manganese, tin, zinc or iron have a maximum resistance to acid corrosion and are becoming increasingly popular.

Alloys containing small proportions of beryllium, cobalt, chromium and titanium, singly or in combination, give excellent physical properties and good corrosion resistance with much higher electrical and heat conductivities than have previously been available in strong alloys. They may be further strengthened by precipitation hardening.

Some work has been done with an alloy of 50 per cent copper, 50 per cent iron, with excellent results so far as strength and casting properties are concerned, but thus far corrosion tests have been disappointing.

BRASS FOUNDRY PROGRESS

By WILLIAM J. LAIRD

Metallurgical Engineer, Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

THERE is little doubt but that the outstanding innovation in the brass foundry in 1936 has been the adapting to practice of the hardenable coppers. The remarkable properties attainable in these copper base alloys, as cast and heat treated, are such as to make it safe to predict that the heat treating furnace will in the very near future, be as fundamental a part of operating equipment in the progressive brass foundry, as a pattern.

A half dozen copper base alloys, possessing, in the as cast and heat treated condition, non-magnetism, corrosion resistance, heat and electrical conductivity approaching that of copper itself with its other physical characteristics in the range previously attainable only in the mild steels, have been successfully reduced to practice. Their existence presages the entry of non-ferrous castings into new and virgin fields.

Entirely aside from the heat-treatment of these alloys, the control required in the compounding, melting, and casting of the hardenable copper alloys is such that they cannot be handled in the fashion in vogue in the average brass foundry. The erratic results obtained in the numerous attempts already made to found these alloys are only further evidence of the crying need of close control and "constitution consciousness" in the brass foundry generally. The current business surge may give sufficient relief from the competitive struggle to permit re-installation of control equipment and personnel that previously existed and was thrown overboard in the re-trenchment.

With the design engineer sorely handicapped in machine construction by lack of available alloy castings having his indicated characteristics, an unwritten back log already exists and eagerly awaits those enterprising enough to move in under the banner of control and precision.

DIE CASTING PRACTICE

By CHARLES PACK

Vice-President, Doehler Die Casting Co., Toledo, Ohio.

IMPROVEMENTS in the art of die casting during 1936 have been outstanding. Progress has been made in many directions tending to reduce the cost of die castings as well as to open up new fields of application. The development of larger die castings has made substantial progress during 1936. No better illustration of this progress can be given than the 1937 Cadillac and LaSalle radiator grilles, shown in the photograph on page 14. In the Cadillac grille, over 1,200, $\frac{5}{8}$" square holes are cast in a grille which must be free from any surface imperfections, a feat considered to be in the realm of the impossible, a year ago. The size limitation to die castings has been definitely removed and during the past year it has been definitely demonstrated that there is no limit as to how large a die-casting can be made.

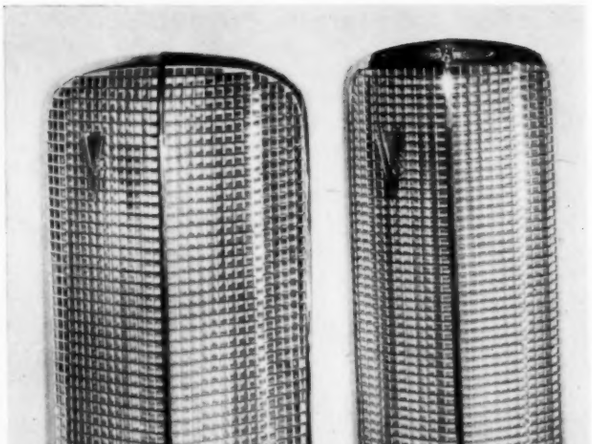
The die casting of brass and other copper base alloys, including nickel-silver, has made substantial progress during the past year. The volume of this business has increased substantially and further developments may be expected to bring the price of brass die castings in closer competitive relation to other methods of brass fabrication.

One of the outstanding achievements in the die casting industry, during the past year is the definite

recognition of magnesium as a die casting material. The use of magnesium die castings has passed from the experimental to the practical stage during the past year and progressive manufacturers throughout the country are checking to see where these die castings can be applied in their operations.

Developments during 1936 have indicated the possibility of producing die castings with thinner wall sections than heretofore deemed possible. This will tend to place the die casting in a more favorable position when compared with other methods of manufacture.

The writer has just returned from Europe where he made an exhaustive study of the die casting industry abroad and no better understanding of the progress made in this country can be had than by comparing it with European practice. American die casting practice excels in all phases. We produce better castings, thinner wall castings, larger castings and produce them at higher speed, with resultant lower costs. This progress will continue during 1937 along the lines outlined above and it is safe to predict that the die casting industry is at the beginning of the most important era in its history. It is the writer's opinion that developments during the past year indicate a possible increase of 100% in the volume of die casting production within the next five years.



Die Cast Automobile Radiator Grilles; Cadillac and La Salle

BRASS ROLLING PRACTICE

By WILLIAM J. PETTIS

Consulting Engineer, Lisbon, Ohio, Associate Editor, METAL INDUSTRY.

IN reviewing a year's progress in the brass mills, the observer finds little to report, in the way of any radical change in the roll practice. While there has been a great deal of discussion on new equipment for various kinds of rolling, no important installations have been made. To bring out a striking comparison it would be necessary to take the mill in use some thirty years ago, and compare it item by item with the mill of today, designed to do the same class of work, and while this might be of interest to the student, its recital lacks a real thrill in this age.

One of the outstanding mechanical improvements is the development of the anti-friction bearings now in use. This technical improvement is born of experiments, worked out in other years, and allows for high rolling speed, with less applied horse power to operate. It also makes possible the maintainance of a reasonably uniform temperature of necks and roll, making it easier to keep uniform the gauge of the rolled strips.

There has been no unusual progress made in experiments started a year or more ago to produce brass strips by the Hazelett process, that we have any

The 4-High or Tandem Sheet Copper Rolls at Revere Copper and Brass, Inc., Rome, N. Y.

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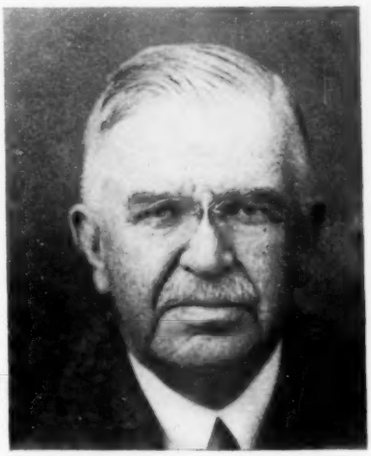
knowledge of. It is possible that the chemist will lead the way in revolutionizing the making of brass strip, ahead of the mechanical engineer. Sherard Cowper-Coles of England was making electrolytic copper sheets of any gauge, said to be equal or superior to rolled sheets.

Brass? Just around the corner!



BRASS ROLLING MILLS

By W. A. WOOD
Consulting Engineer, New York.

DUE to the acute military situation abroad, brass and copper rolling mills are now being built in Yugoslavia, Rumania, Japan, Persia and contemplated in Poland, Belgium and other countries.

1. All breaking down is hot.
2. Slow speed and heavy pinches.
3. Friction rolling both hot and cold.
4. Reversing mills.
5. American automatic and semi-automatic fixtures.
6. Diesel engines.

In line with our larger Navy and Air development, and the potential industrial mobilization for war materials, together with the Government's four billion dollar gold cache in Kentucky, a look at the map showing the location of the major portion of our brass and copper fabricating plants in New England and along the Great Lakes clearly shows their military vulnerability, as well as their transportation handicap, and the absolute necessity of a better locating of new mills.

The present rolling mills have inherited too much universality in not keeping abreast of other industries in specialization. There is an opportunity for many new mills such as:

Narrow Strip Brass Mill Corporation,
Brass House Pipe Corporation,
Line and House Wire Corporation,
Non-ferrous Hot Pressing Corporation, etc., etc.

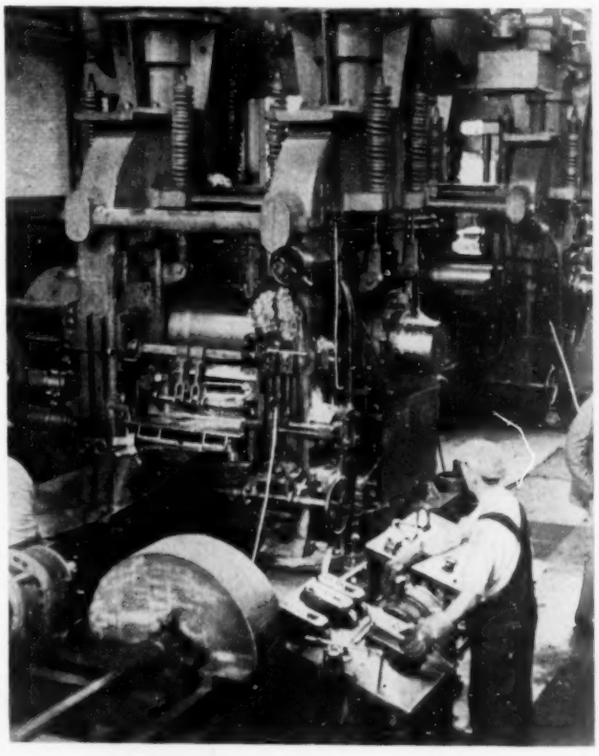
In our own mills, mechanization is gaining in pace, in meeting the challenge of higher wages, shorter hours, higher metal costs and other new costs; application of proved processes as short cuts for older and more conservative processes as, for example, hot pressing, that eliminates the rolling mill and much of the drawing department.

THE COPPER AND BRASS FABRICATING INDUSTRY

By BERTRAM B. CADDLE
Secretary, Copper & Brass Research Association, New York.

AFTER a somewhat hesitating and nervous start business in general got into full stride during 1936 with the result that toward the close of the year most departments of the copper and brass fabricating plants of the country were operating at 85 per cent capacity. It was by far the best year for our industry since 1929, the last of the so-called post-war "boom" years. The outlook for 1937 is most encouraging and it would not be surprising to see the great tonnage of 1929 approximated or even exceeded.

Many new all-time sales records were broken last year by the copper and brass industry. These include the largest tonnage of brass pipe and copper tubing for water lines ever sold in the history of the industry;



Close-up of 4-High Sheet Copper Rolls at Revere Copper and Brass, Inc., Rome, N. Y.

record sales to manufacturers of mechanical refrigerators, the oil burner and air conditioning industries.

The electrical industry is the greatest consumer of copper and its alloys. Since July of last year the electric power consumed has exceeded two billion kilowatt hours per week. That establishes a record. The increase is due to the fact that many industries have increased production necessitating both day and night operation and also to the large number of homes that have been electrified.

It is estimated by the Edison Electric Institute that two-thirds or 21,000,000 American homes are today electrified. Of that amount 97 per cent have one or more labor-saving devices. The wiring of the homes and the use of these appliances consume large tonnages of copper.

Rural electrification is being rapidly developed. Many thousands of homes in cities and small towns as well as on the farms will be electrified in 1937. The public utilities of the country long reluctant to buy equipment or develop new lines must through necessity carry out a program to increase the amount of power. Most of these companies are already finding the power-load of their plants taxed to capacity. This development in 1937 will be a great consuming field for copper and its alloys.

The automobile industry is the second largest consumer of copper. With sales quotas fixed by executives of the automobile and truck industry totalling 5,000,000 for this year this industry will use about 250,000,000 pounds of copper, brass and bronze. Of that total 225,000,000 will be used for new models and 25,000,000 for replacements and parts in the cars and trucks now in service.

Next to the electrical and automobile industries ranks building. It is estimated that about 435,000 new housing units will be constructed this year. New construction and necessary repairs will require large amounts of copper and brass for water lines; roofing materials; hardware, lighting fixtures and insect screens. During 1936 our industry established a new all-time record of some 15,000,000 more pounds of brass pipe and copper tubing sold than ever before. In 1937 this record will again be smashed if building, as anticipated, at last gets into its stride.

Sales of copper and its alloys to the mechanical refrigerating and air conditioning industries in 1936 exceeded 60,000,000 pounds which is another new all-time record. The oil burner industry last year consumed about 20,000,000 feet of copper tubing which is another record-breaking use of copper tubing by a consuming industry.

The manufacturers of products using copper and its many alloys are for the most part quite "bullish" on the outlook for 1937. If their estimates are realized then the copper and brass fabricating plants of this country will have one of the best peace-time years in all history—if not the best. Sales may even exceed those of 1929.

COPPER AND BRASS MILL PRODUCTS

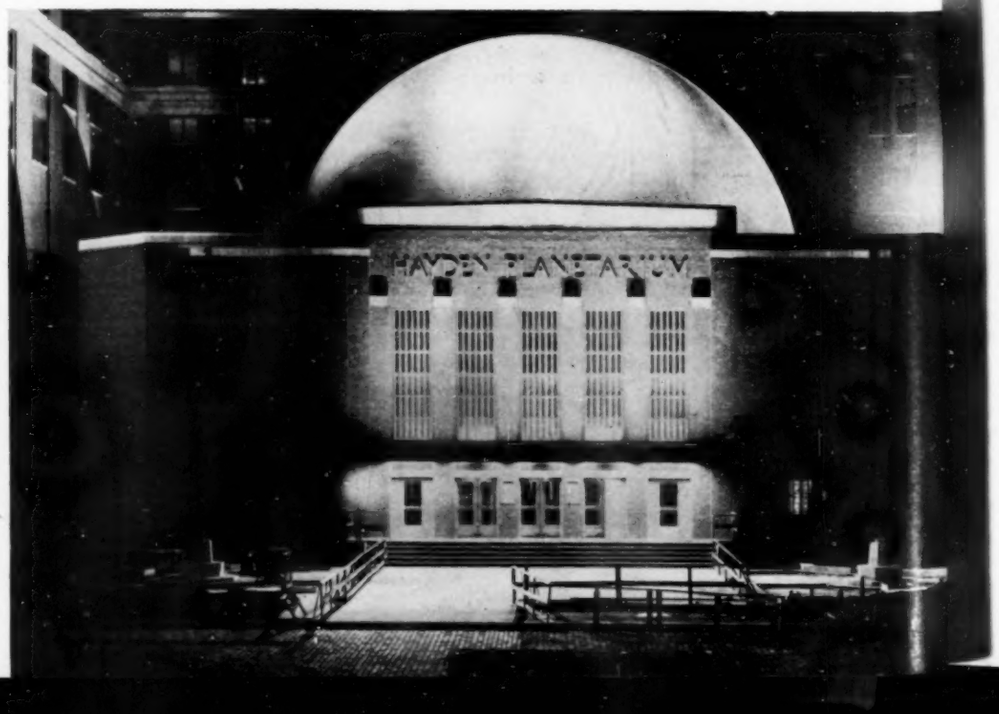
By J. J. WHITEHEAD

President, Whitehead Metal Products Co. of New York, Inc., New York.

DURING 1936 there was an extensive improvement in the business and profits of distributors of copper and brass mill products. Basically of course, the improvement in general business conditions was responsible for the increased volume of sales. In addition to this, however, there has been a constantly widening market for non-ferrous metals. In all lines of industry there has been a growing appreciation of the savings obtained by the use of non-rusting and corrosion resisting metals.

All three of the major branches of the non-ferrous metal industry have felt the impetus of the public acceptance of this fact. In industrial plants where engineering knowledge is employed to test and select suitable metals for various applications as for instance, in the textile, chemical engineering and food processing fields, it is naturally to be expected that non-ferrous metals would demonstrate their superior characteristics. But this development is not confined alone to those things which have the benefit of skilled engineering.

The average man in all walks of life is today more conscious than ever before of the economy and benefit to him of using non-ferrous metals in the home. He has come to realize that he is saving money when he invests in plumbing installations with brass or copper pipe and his hot water tank of nickel or copper alloys. He knows that copper on the roof and in leaders and



The Hayden Planetarium at night, showing the sheet copper dome

Photo, Courtesy Copper & Brass Research Assn., New York

gutters on his home is a lifetime investment paying big dividends. The average man knows that when he equips the kitchen in his home with Monel metal work surfaces and substantial aluminum utensils, that he is making a lifetime investment, and all of these things he can do at only a slight increase in cost over the price of those materials which corrode rapidly and need frequent replacement.

Also the non-ferrous metal distributors have begun to realize that there is a large field for their efforts in sales promotion work to still further the sale of these products. In addition to this, the producers of non-ferrous mill products have come to realize the importance of having an intelligent, enthusiastic and active group of distributors pushing the sale of their products and keeping always on the alert for new uses for them.

All these things coupled with general business activity are what have made the past year a very satisfactory one for the distributors.

During the year there has been a revival of interest in the National Association of Distributors of Copper, Brass, Bronze and Related Alloys. That association, formed under the NRA codes, has been kept alive since the expiration of the codes to consider and develop ways and means of improving the industry. A definite program is now under way. It is hoped that in cooperation with the Copper and Brass Research Association and the producers of non-ferrous products, a national plan for assisting distributors will be developed to carry forward educational and development work in various territories throughout the country, promoting the use of non-ferrous products so that in the coming year it may be found that intelligent, cooperative effort will bring benefits of considerable interest to the entire industry.

METAL PRODUCTS MANUFACTURING

By CHARLES W. HARDY

General Manager, Mondaine Products Corp., New York.

MANY improvements were made in the processing of sheet metal articles. The most outstanding of course, are those that decreased the direct labor, saved floor space and produced the work as good or better, insofar as quality was concerned.

Automatic soldering by conveyor was a noteworthy accomplishment, for both hard and soft soldering. It was a big improvement over the old method of soldering with a hand blow torch. The heat and time feature is predetermined and accurately controlled. The work produced by this method is much better and is easier and better to finish to a high polish.

Conveyor method of air drying before lacquering, etc.; also for drying bright nickel work without stains, etc., was developed and is producing very satisfactory results for a large local manufacturer of electric light socket, plugs, etc.

Brocading, engine turning and engraving is being done by machines for quantity production, that is as sharp, and in detail so similar to the old slow and costly method of hand engraving that it is very hard to detect, when it is produced by machine. Besides which, it produces a two color job, either after plating, enameling or aluminum color plating and has a tendency to burnish the base metal where removed. This result is not obtainable by a power press or drop hammer operation.

Automatic buffing machines have been improved and many of the problems of chucking (holding of work) have been solved. Also the variable speed control attachment (to take up for wheel wear) is helping to produce a better job and cheaper. A machine perfected and placed on the market during the year for cutting down and/or coloring both non-ferrous and ferrous metals in strip and sheet form will be a big help to many fabricators of the metal in this form.

Solvent Degreasing: the redesigning of machines; the changes in distilling and removal of sediment, the saving and reclaiming of expensive solvents, the elimination of fumes, etc., are welcome changes. The degreasing process is here to stay and is a big help to our industry. It lowers the cost and at the same time, produces a cleaner surface and gives a better quality of production.

Prefinished stock this year, has proved that this type of raw material is practical and is a big help to the manufacturer who can use it.

Stellite used for constructing many dies and tools, has proved to be a big improvement over regular tool steel and many special types of tool steel for certain kinds of blanking, forming channeling (etc.), dies. Users report 100 to 500% longer life of die edges, less surface scratches, lower tolerances and a better all around job; much less repair and maintenance expense.

MACHINE SHOP PRACTICE

By W. B. FRANCIS

Associate Editor, METAL INDUSTRY.

THE practice in machining non-ferrous metals has progressed along two general lines. In the first place machine tool builders are advertising new designs and major improvements. In the second place there has been a rapid growth in making non-ferrous articles in a direct line of production that does not require machining operations as finishing processes.

As to the machine tools, the new designs that aim to promote automatic actions, greater accuracy and larger productions, have a bewildering effect on the observer. It is difficult to name some of the machines according to the older classification, especially where streamlining is attempted. The new ways of making things have caused a race between the machine tool builders to adapt their standards to the new requirements. This race applies to all the machines that have been available for years—lathes, planers, shapers, grinders, broachers, welders, millers, borers, drillers, polishers, presses, benders, extruders, shears, dies, and what not.

The turret lathes, screw machines, and multiple spindle automatics have improved for speeded production and better finishes, and for reduced tolerances. Superior finishes are now produced on the multiple-wheel automatic grinding and polishing machines. Also different faces and different contours are finished at the same time. Broaching, that was once a minor machining process, is now a standard for both inside and outside surfaces, and for multiple surfaces at the same time. The machines are hydraulically operated and finish work pieces to an accuracy of flatness and quality never before attained. Also by using the tungsten-carbide tools the production is higher than ever thought possible.

The extruding process uses ingots or billets either hot or cold under hydraulic pressure, which causes the metals to flow through dies. This produces long strips of most any desired section. Thus for brass door hinges, the strip has a thin rectangular section with a heavy circular section along its edge. The heavy edge of the strip is then quickly notched for mating parts of hinges and the parts cut off either before or after the screw holes are made. Many of the extruded shapes need little or no subsequent finishing.

The leading process for production of non-ferrous pieces with the aim of avoiding subsequent machining entirely, is that of die casting. The die castings are low priced, durable, strong, and of any ornamental attractiveness desired. Molten metals are used in the dies under pressure. The castings may be solid or hollow and of most any intricate form. The holes may be accurately centered and at any angle through the piece. Die castings are now made of considerable size, as for example the latest models of front grills on automobiles. The expansion of the die casting process has been very rapid.

Most non-ferrous metals lend themselves readily to press forging operations that produce usable shapes that require very little finish machining. As press forging machines are rather expensive, mass production is needed for the greatest economy. However, it is by mass production that we have our industrial salvation—because the consumer gets the advantages of numerous modernized conveniences and necessities at a low cost, while our expert labor gets the highest wage returns in the world.

The improved gas and electric welding processes have boomed non-ferrous fabrications. The electronic tornado system of automatic carbon arc welding applied to brass and copper produces welds that have the same composition as the parent metals. They also have the same physical characteristics.

INDUSTRIAL HEATING OF NON-FERROUS METALS

By C. D. BARNHART
W. S. Rockwell Company, New York.

YEAR before last Mr. Buyer of non-ferrous products was making himself hoarse calling for refinements in finish in the mills, and back of the mills the furnace manufacturers were hard put to meet the requirements. But in '36 the situation has been somewhat changed.

In '35 a few of the enterprising mills had gotten under way processes which enabled them to meet Mr. Buyer's demands, and '36 has found many other mills equipping themselves to meet his exacting requirements in order to enable them to keep their share of the business.

Also in this past year the mills have sensed the existing wide difference in practice between the non-ferrous and ferrous industry in regard to the weights of the bars or slabs handled, so that mills of the future are likely to follow the steel trend, and also the practice of some of their non-ferrous fraternity, and plan to handle heavier units. This is a logical development in view of the fact that mechanical equipment has taken the limits off the weights that can be conveniently handled.

Perhaps a jaunt to what might be termed a today's imaginary mill would be of interest. By this we mean a mill in which many of the new '36 practices are in operation. As a special flight of fancy we might imagine that we see some things done that will probably not be generally adopted until '37.

We would see standard copper wire bars handled at the rate of 80,000 lbs. an hour, and coils and spools of heavy wire annealed bright in steam atmospheres by wet processes, and smaller spools of finer wire annealed bright and dry in furnaces of the hood or lift out type.

We would see copper and brass hot rolled for strip metal starting with cakes weighing possibly over 1,000 lbs. The intermediate slabs would be annealed continuously and the thinner metal annealed in strip form with continuous pickling for brass and bright annealing for copper even when in coil form.

We might see some brass being fed molten to the rolls and brought out as a moderately thin sheet, although not so much of this.

We would see Mannesman machines out in the scrap and gigantic presses extruding tubes and rods from heavier cast slugs, or cathode copper slugs heated in new designs of billet furnaces providing the extreme uniformity required by these modern machines. Also "kneading" machines giving a very fast reduction in section with a great reduction in the amount of annealing required.

We would see much larger size conveyor chain or roller hearth furnaces for annealing brass tubes fairly clean, or copper tubes bright, the capacities running up to 18,000 or 20,000 lbs. hourly per furnace unit. The work would be quenched at the end of the heating and handled directly through the furnace gases. Also, almost a general use of conveyor furnaces for handling coiled copper service pipe or straight tubes bright and dry. We would notice that the atmosphere in contact with the metal was taken by special methods and processes directly from the furnace exhaust gas flues with a total expenditure for fuel only a little more than that required alone for the separate production of protective atmospheres in the earlier furnaces produced for this class of work. We would see all manner of conveyor type furnaces for brazing brass parts, silver inlay and soldering.

There would be evidence of a steady growth of pressure castings, of special brass compositions, with metal dipped from gas or electrically heated holding furnaces. Also, almost a general standardization of

the small pusher tray type of furnace for serving hot forging presses. There would also be a great increase in the use of powdered metal pressed into all imaginable shapes and coalesced, the parts being impregnated with oil or grease where used for bearings, and produced with a solid non-granular finish where used to replace cast shapes.

For handling coiled brass where the grain sizes had to be maintained accurately we would note that gas was being used as fuel, and on checking back we would see that this same fuel was being quite generally used even for work which had not yet been considered exacting. We would see that gas fuel, with the atmosphere which it produced and with its ease of accuracy and control, had been outstripping electricity and oil on new equipment installed even at a higher fuel cost than oil.

In short, we would see that Mr. Customer is in a position to get a quality of metal and a finish that are almost perfect, and that Mr. Mill Man has put himself in position to give Mr. Buyer this service more cheaply than ever before by virtue of new equipment and new methods generally.

POWDER METALLURGY

By R. L. PATTERSON

Engineer, Hardy Metallurgical Co., New York

DURING the past year a rapid expansion occurred in the use of powder metallurgical processes, wherein metal powders are mixed, pressed to articles of exact shape and size, and heat treated to obtain the characteristics desired. Mixing equipment, power presses, and sintering furnaces became fairly well standardized. In a few plants automatic and continuous equipment made their appearance.

While the electrical industry, where tungsten and molybdenum wire is drawn from metal powder billets, is regarded as the cradle of powder metallurgy, it is the automobile industry that has stimulated its growth to an output of many tons per day. In this industry powder metallurgy has experienced a "vertical" expansion from the well known self-oiling, porous bronze bearings to the present day motor car's requirements of a hundred or more compressed parts, which include bushings, knuckles, cages, pinions, generator brushes, commutator segments and body hardware.

From this industry there also has occurred a "horizontal" expansion of metal powder applications into other industries, as represented by bearings and parts for electrical motors, refrigerators, air conditioning, clocks, textile spindles, washing machines, typewriters, casters, etc.

The past year witnessed a noticeable change in the manufacturer's attitude toward powder metallurgy. Formerly a manufacturer or metallurgist turned to powder metallurgy only "as a way out," to accomplish an end not possible by usual methods,—to unite metals of widely divergent melting points, to combine metals with non-metals, to obtain porosity or control density, to avoid impurities, to obtain exact compositions, or to eliminate the losses and costs involved in melting, and machining operations. During 1936, however, many manufacturers, awakening to the possibilities of powder metallurgy, instituted surveys of their plants to determine what products might be best manufactured by these methods. Experimental laboratories were established in a number of plants and this has resulted in a demand for men with powder metallurgical training. The versatility, or the wide range of characteristics obtainable with powder metallurgy, is emphasized by the following outstanding developments of the past year.

Magnetism—Permanent magnets made from compressed metal powders are capable of lifting 60 times their own weight.

Porosity—Ink blotters, lamp wicks, oil burner parts and bearings compressed from iron powder have highly absorbent qualities.

Fusibility—In the alloying of metals, thorough diffusion and quick solution is accomplished by adding the alloying metal to the molten bath in the form of briquettes of fine metal powder. Increasing amounts of metal powder are passing into welding rod as sprayed, or fused coatings, or as incorporated material.

Refractoriness—Metal powders and non-metals, such as porcelain or cement, are pressed into resistors of exceptionally high resistivity and long life.

Purity—Metal powders free from oxygen, sulphur, and other impurities, compressed into cores make possible radio and telephone equipment of greatly reduced size.

Decoration—Applied to paper, rubber, bakelite and other plastics, metal powders provide impressive decorative effects.

Strength—Alloys of superior strength are produced from powder briquettes; not surprising when we remember that the highest tensile ever achieved, 650,000 psi, is that of tungsten wire drawn from a metal powder billet.

Exothermic—Many tons of metal powder enter the beauty shops to generate heat in machineless permanent wave pads.

WELDING COPPER ALLOYS

By I. T. HOOK

Research Engineer, American Brass Co., Waterbury, Conn.

NINETEEN thirty-six has been quite largely a transition year. Though bronze welding has grown apace with improving business conditions and the fabrication by fusion welding of copper and copper alloy equipment has made satisfactory progress, most of the developments started during the past twelve months will not bear fruition until we are deep in 1937. Notes on some of these developments are as follows:

Copper Alloy Wearing Surfaces. Transportation companies have found that their largest gains in

Photo, Courtesy Linde Air Products Co., New York

Commercial yellow brass pipe for building service, if it is designed for permanent, leakproof service, is now joined by means of the oxy-acetylene welding process

cutting overhead costs are by keeping their rolling stock in operation. Any design that will contribute to this end is being given close scrutiny. The railroads, for instance, find that by coating the hub faces of the locomotive drive boxes, the front and rear faces of the locomotive frame pedestals, the periphery of the piston heads and other wearing surfaces with bronze, they can run the locomotives more miles between "shoppings."

Much progress has been made in applying these bronze wearing surfaces. Various phosphor bronzes, copper-silicon alloys and manganese bronzes are being applied. In some cases, the manganese bronze is flowed onto the cast steel or iron with the oxy-acetylene torch.

A method of applying beryllium copper to steel or copper by means of the carbon arc was developed. Though limited in its commercial application at present, beryllium copper has some very desirable wear resisting qualities.

Detailed procedures for welding beryllium copper were published in August and September Industry and Welding.

Heat Exchangers. Much progress has been made in the manufacture of condensers, heaters, coolers, economizers and other types of heat exchangers. Formerly, such equipment was made by the use of thick copper alloy headers with rolled-in copper alloy tubes. Recent designs make use of thinner deoxidized copper headers with brazed or silver-brazed tube connections, the header in turn being welded to the shell.

The core of one small radiator was made of thin steel sheets copper-brazed and protected. The sheets are formed to make the water tube walls and air fins integral.

Resistance Welding Anniversary. 1936 marked the fiftieth anniversary of commercial resistance welding which was started by Prof. Elihu Thompson in 1886. We congratulate Prof. Thompson on the achievement. Resistance seam welding of copper alloy sheets for small containers, refrigerator evaporators and similar equipment showed good progress. Several new copper alloys with good seam welding characteristics were made up. Chromium copper for resistance welding electrodes is still sufficiently new to warrant mention.

Cupro-Nickel Sheets and Tubes. The 70:30 cupro-nickel is in demand for condenser tubing and salt-water plumbing. Gas welding procedures were worked out for all types of position welding for the sheet as well as the tubes.

Copper Welding. Some very good progress was made in the gas welding and arc welding of tough-pitch and deoxidized copper. The carbon arc welding with the use of phosphor bronze or Everdur welding rod has proved an economical method of fabricating copper. Improvements in gas welding are also forthcoming.

SILVERWARE MANUFACTURING

By Dr. B. EGEBERG

Chief Chemist,
International Silver Co.,
Meriden, Conn.

EXCEPT for slight changes in appearance brought about by changes in ornamentation, the forms and shapes of silver-ware remain substantially the same from year to year. These shapes have been accepted by the public as most satisfactory and any radical change is likely to meet with sales resistance.

The same holds true with the metals employed in the making of silver-ware. The industry and the public have long ago reached a decision as to the alloys best adopted for silver-ware whether it be articles made from solid silver or articles made from a base metal electro-plated with silver.

The silver-ware industry has, therefore, advanced to the enviable or deplorable state, depending upon the point of view, that no great novelty can be expected from year to year: enviable, because of the many hundred years of study and experience in making an article of lasting beauty fit for a domestic purpose; deplorable in other ways because it has no new sales arguments from year to year.

From the above, it is evident that there must necessarily be very little to write about the technical advancement of the silver-ware industry in such a short period as only one year. However, a few things are worth mentioning.

In the field of electro-deposition, there has been a tendency toward the standardization of the thickness of the plate, which in turn has led to further study of methods for conveniently measuring such thickness

Manufacturers are discarding more and more the old hand cleaning and plating method and are strongly in favor of automatic machines for doing this work. This naturally, pertains only to the larger manufacturers having sufficient volume of production to warrant the expense.

Stainless Steel, many years ago, invaded the field of table cutlery to the near exclusion of carbon steel, although the latter is recognized as having somewhat better edge holding qualities. The deficiency of stainless steel in this respect has not been felt so much in the ordinary table knife as in carvers. This condition has now been rectified in that a stainless steel of exceptional hold-edge qualities has been perfected filling all the many demands of cutlery forging and grinding on a production scale.

Returning to the two alloys mainly used in the making of silver-ware, it has been recognized for some time that during the furnace treatment of the cold worked alloys other changes take place besides recrystallization and softening.

In nickel silver, this fact has in the past been of considerable disadvantage, manifesting itself by the cracking of deep drawn articles during the early stages of annealing when the temperature of the article is in the vicinity of 700°F. By introduction of conveyor type furnaces where the deep drawn shells receive a slow and gradual heating compared to the older batch type furnaces, cracked shells have practically disappeared.

In Sterling silver, the changes referred to above have not been a disturbing factor as in nickel-silver. However, it is only recently that the trade has realized that these changes can be put to use. Sterling is a very pliable metal and in the past it has been the custom to rely entirely upon cold working to provide for sufficient strength and stiffness of the finished article. In this respect a change has taken place. It has become more and more general practice to heat-treat this alloy to the required stiffness. In this way, manufacturers can make themselves entirely independent of cold work for obtaining the required strength and during the last years they have extensively proceeded to do so. To avoid excessive fire staining, an atmosphere controlled furnace for the high temperature treatment is usually employed.

JEWELRY MANUFACTURING

By C. M. HOKE

Consulting Chemist, The Jewelers' Technical Advice Co., New York.

AFTER seven lean years, the "advance" that interests the jewelry world is the advance in gross sales. Of course jewelers are also artists, and advances in technique and artistry are appreciated too; but we would be more than human if we should do other than rejoice at the return of real prosperity.

According to Dun and Bradstreet, sales show advances of from 20% to 40% over 1935; some divisions showing as much as 75%. Wedding and engagement rings have sold in larger quantity than in any year since 1929; and an actual scarcity has developed in fine diamonds of a carat or more. Attleboro and other jewelry centers report gratifying increases in employment figures and payrolls.

New Materials

It seems odd to speak of gold as a "new" material for jewelry. But it was in eclipse for so long that it is now a pleasure to welcome it in the new designs. Natural gold, or a coppery red gold, are the favorite colors, and sometimes two or three shades are combined. Not that platinum is passe; many a glorious display shows nothing but platinum; but gold is again on an equal footing with it in Fashion's eyes.

New materials appear in costume jewelry every season; some like the colored plastics are well established. Stainless steel has been accepted, especially for sports jewelry, to an extent that has astonished the old timers. Rhodium plate is gradually replacing chromium plate.

New Methods

When the Bureau of Standards formulated specifications for rolled and filled gold, it challenged the makers to standardize their methods of manufacture. The girl who sports a rolled-gold bangle may be quite unconscious of the care with which it was made, or the significance of the little stamp that indicates its quality; but to the retailer these are matters of importance, based securely upon the metallurgical skill and technical acumen of our day.

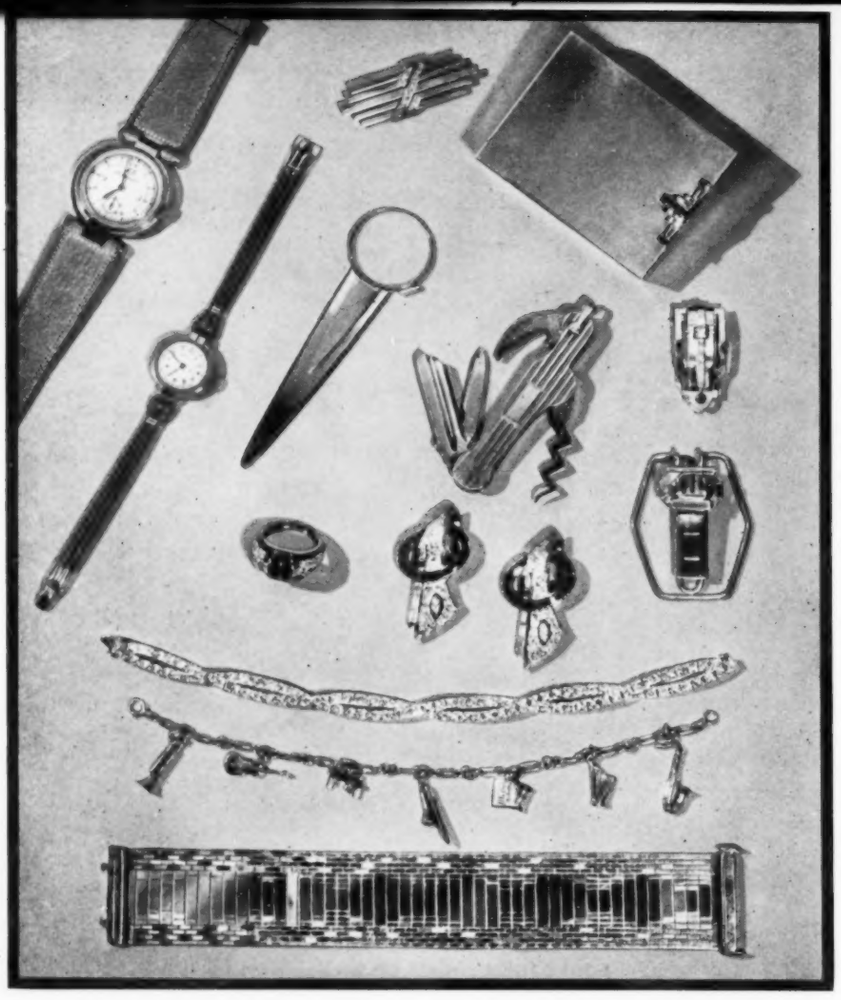
New Designs

The modernistic influence, with its flat terraced surfaces, seen first in architecture and home decorations, is now shown in jewelry. The plane may be of polished metal in facades or strips, or of stones laid close together like paving blocks. Another modernistic quirk is the asymmetrical design, seen in rings, clips, and brooches especially.

The clip is again popular; masses of stones are packed together to form huge ornaments of every school of design. The men have their clips too—tie clips and bill clips—decorated with monograms or combined with a key holder or cigar cutter. Articles that come apart in unexpected ways are popular; a brooch or bracelet breaks up into two clips; cigarette cases are combined with powder-sifters and lipsticks; all to satisfy the Yankee love for gadgets.

Stones show baguette, marquise, triangular and other odd cuttings, and a bank of baguette diamonds, set parallel, is a favorite motif.

Costume jewelry has become literally a part of the costume—a frock when purchased is adorned with its proper necklace or buckle, sewed in place. Floral designs abound—leaves and scrolls, delicate golden roses as large as life, and rhinestones in glittering icy banks. Costume jewelry has advanced in several ways—in artistic grace, in the size of the individual pieces—for great plates of metal adorn milady's person—and as we said before, in that practical matter of gross sales.



JEWELRY OF TO-DAY

Gold watch with strap; gold watch for a lady; gold and diamond brooch showing modernistic terraced planes; silver and gold vanity with baguette stones; combination letter-opener, bookmarker, and magnifier; gold key, knife, corkscrew and opener; gold and diamond clip; gold key and bill clip; ruby and diamond ring showing closely placed stones; pair of sapphire and diamond clips with marquise and baguette stones in off-center design; twisted flexible bracelet; gold bracelet with charms; three-toned gold mesh bracelet in modernistic design of flat polished planes

Photo, Courtesy of Marcus and Company, New York

The Metal Coating and Finishing Processes

HOT-DIP GALVANIZING AND TINNING

By WALLACE G. IMHOFF

President, The Wallace G. Imhoff Co., Vineland, N. J.

1. Combustion Engineering of Galvanizing Furnaces:

The combustion engineering of hot-dip galvanizing pots has always been one of the most difficult of all heating problems due to the destruction of the pot itself by improper heat application, extreme heat intensity, distribution of the heat developed, and the incorrect relation of pot design, pot size, etc., to production put through the furnace in a given time.

The past year has been one of very active development to try to solve the problem in a more satisfactory manner. Several new furnaces have been placed on the market with new features for this purpose.

2. Automatic Control:

Along with these interesting strides in heating the galvanizing furnace have come the great increase in operating efficiency due to a much wider application of automatic control, and the use of electric recording pyrometers. The vital factor of temperature is being more definitely regulated and controlled.

3. Submersion Time:

Still another advance has been the recognition of the importance of submersion time in the zinc bath. One very large galvanizing plant has developed special equipment that definitely controls the submersion time of every article in the zinc bath.

4. Pickling Fused Scale from Covered Welding Rods:

The entire galvanizing industry has also been confronted with the new problem of removing hard fused scale developed from covered welding rods. This has been a very serious menace to good galvanizing on welds made by these rods. Attention is now being given the problem by wire manufacturers, the American Welding Society, and the American Hot-dip Galvanizers Association, Inc., 903 American Bank

Building, Pittsburgh, Pa., in the hope of finding an early solution.

5. **Specifications for Aluminum in Galvanizing Baths:**

Another feature of much importance, and something that little seems to be known about, is definite specifications for aluminum in hot-dip galvanizing baths. Due to the many variables involved this problem has been one of the most difficult to solve. The past year has been one of intensive interest in this question, and work is still being done to find out more about the action of this metal in galvanizing baths, and its influence upon the zinc coating.

6. **Active Interest in Galvanizing:**

The American Hot Dip Galvanizers' Association, Inc., 903 American Bank Bldg., Pittsburgh, Pa., has sponsored a program of customer education on the protective value of hot-dip zinc coating on iron and steel.

7. **Formation of Galvanizers' Committee:**

A Hot Dip Galvanizers' Committee has been formed to consider the various technical phases of the industry. F. G. White, Granite City Steel Co., Granite City, Ill., is chairman.

HOT-DIP TINNING

1. **Hot-Dip Tinning Furnace:**

As with other soft metal melting furnaces the main feature of a hot-dip tinning furnace is that it be so designed that the required amount of heat can be supplied without overheating the tin. A new furnace has given satisfactory results in this field, due to the fact that only the products of combustion, come in contact with the pot.

2. **Hot-Dip Tinning Malleable and Cast Iron Castings:**

Due to the fact that there is no standard authority on hot-dip tinning of castings this subject has been of active interest in the past year. In most cases the trouble has been due to improper cleaning of the castings before coating. In some cases actual coating troubles were noted due to overheating of the tin bath, flux spots, and difficulty in properly setting the coating.

3. **Hot-Dip Tinning of Brass Castings:**

Active interest has been expressed in the past year in obtaining a proper hot-dip tinned coating on brass castings. Difficulties again have been due to improper cleaning methods, and overheating of the tin bath.

4. **Hot-Dip Tinning of Strip Steel:**

The increasing use of hot-dipped tinned strip steel has been shown in the past year by inquiries for tinning methods and equipment necessary to properly carry on this work.

5. **Continuous Hot-Dip Tinning:**

Now that continuous strip mills are turning out sheets known as wide strip steel, the next step is to coat this material continuously with tin. Active research is going on to eliminate some of the most difficult problems, and there is no doubt that in the not distant future continuous tinplate will be a reality.

ELECTRO-METALLURGY

By Prof. COLIN G. FINK

Head, Division of Electrochemistry, Columbia University, New York.

THE outstanding accomplishment in electrometallurgy during 1936 was the electrodeposition of pure manganese. Three laboratories cooperated in the development of the process. A manganese ammonium sulfate solution is used and the metal, when properly prepared, is mirror bright and stable in the atmosphere indefinitely. It analyzes 99.9 per cent pure. The process is simple and plates any desired thickness can be deposited.

Another noteworthy event of 1936 is the introduction into industry of the writer's electro-tin process which is to take the place of the old hot-dip tin plate process. The new tin plate is practically free from pinholes, the usual ailment of the hot-dip tin plate.

Among the rarer metals, **Price** and **Brown** have developed a solution for the electrodeposition of molybdenum, and **Bradt** and **Linford** obtained white deposits of zirconium metal from a solution of sodium zirconyl sulfate.

The introduction of "wetting agents" has opened up a new field in the production of nickel plate which promises to be a real protective coating for steel and other basis metals.

From a decorative metal point of view, there is much interest being displayed in the ripple effect produced by high frequency sound waves on electrodeposits of cobalt, iron, cadmium, zinc, and others. **W. T. Young** and **H. Kersten,** of the University of Cincinnati, are among those who have contributed interesting data on this effect.

The electrolytic cadmium plants were hard pressed but in spite of increased production, they could not meet the demands of the users of high cadmium alloy bearings which are being used in place of babbit.

The Beryllium Development Corporation has moved its plant to near Reading, Pennsylvania. The main consumption of beryllium continues to be for the beryllium-copper alloys. Many thousands of springs of this alloy have withstood millions of flexures, competing in this respect with steel, but superior to steel springs on account of the alloy's resistance to corrosion.

Polonium, one of the ultimate disintegration products of radium, is now readily recovered with the high-speed cathode; 90% recoveries are not unusual.

Sodium metal produced from a fused bath of sodium chloride has reached a total volume equal to the major metals. Tank cars with forty tons of sodium metal are being shipped from place to place.

Strontium metal and barium metal likewise produced by the fused electrolyte method are finding increasing application in the vacuum tube industry.

METAL CLEANING

By WALTER R. MEYER

Electrochemist, General Electric Company, Bridgeport, Conn.

DURING 1936, steady progress was made in the application and development of three general methods of cleaning; namely, vapor-solvent degreasing, emulsifiable solvent cleaning, and alkaline cleaning. The progress has consisted in a large measure of engineering applications of known detergent methods but the recent commercial availability of new chemicals has contributed to the success of the development of new cleaning materials.

Vapor-Solvent Degreasing

Simple vapor degreasing has not proved to be satisfactory for the cleaning of light gauge metals because the amount of vapor which can condense upon work with thin walls is not sufficient to completely clean the work. This difficulty has been overcome by the use of various combinations of solvent and vapor cleaning. One cycle that has been used extensively throughout the year is: (1) immersion in boiling solvent, (2) immersion in relatively clean solvent which forms by the distillation of bath No. 1, and (3) vapor cleaning to remove small amounts of oil remaining on the work from bath No. 2. This system has been completely conveyorized enabling rapid and efficient cleaning of all types of work. The advantages of this type of cleaning over aqueous cleaning methods are: freedom from attack on reactive metals such as zinc or aluminum; penetration of holes, pores, and crevices to remove organic materials which may interfere with the plating process if not removed (this feature is particularly important for zinc base or aluminum die castings and for cast iron sand castings); rapid drying due to the volatility of the solvent; and low material cost for properly designed machines.

In addition to the engineering developments in degreasers during the past year, new solvents have been tried in place of the standard tri-chlorethylene. The requirements of the solvent are severe as it must have comparative freedom from hydrolysis, a suitable boiling point and latent heat of condensation, low toxicity, low cost, good solvent power for various mineral, animal, and vegetable oils, and be non-explosive. Chlorinated compounds appear to be the only substances which have a major portion of these qualities and throughout the year ethylene dichloride began to find some use in degreasers.

Emulsifiable Solvent Cleaning

Emulsifiable solvent cleaners have been used to good advantage for removing smut from cold rolled steel, and for removing drawing compounds contai ing fillers. Due to the low alkalinity of this type cleaner, they have been used for cleaning reacti metals such as copper-hardened zinc without dullin the luster of the bright rolled surfaces. Emulsifiabl solvent cleaning has found particular applications fo basket cleaning previous to alkaline cleaning befor barrel plating, and for cleaning large objects "in situ such as automobile engines, machines, etc. It ha been used successfully without a subsequent alkalin cleaning for cleaning work previous to japanning, lac quering, or enameling.

Aqueous Alkaline Cleaning

Electrocleaning has been applied more and more with the use of two separate tanks, the first making the work the cathode, and the second with the work as the anode. The first tank performs the major cleaning operation and the second tank deplates or oxidizes any smut deposited in the first tank. Anhydrous orthosilicate has become commercially available so that a saving in freight can be effected over the hydrated salts. Graded buffered alkalinity is now available from ortho-, sesqui-, or meta-silicate. The newer wetting-out agents are gradually finding use in metal cleaner formulations in which they have not been able, however, to replace the standard soaps entirely but rather are used in conjunction with soaps

THE STRUCTURE OF ELECTRO-DEPOSITS

By Dr. LOUIS WEISBERG

Louis Weisberg, Inc., New York.

THE future of electroplating is going to be profoundly influenced by studies now being made of the structure of electrodeposits. These studies involve problems as difficult and involved as any in the whole field of chemistry and physics.

An excellent example of the application of metallographic methods to a problem of this type is the work of McNaughton and Hothersall in studying the effect of inclusions of finely divided nickel oxide on the hardness of nickel deposits. As long as the grain size is large enough to be seen with the microscope, that is the most direct way to follow the connection between grain size and physical properties. It also shows the effect of the crystal structure of the underlying metal.

The real crystal structure, however, is much too fine to be resolved by the microscope, for this involves the arrangement of the atoms themselves. Two methods of studying this are available—X-ray diffraction and electron-diffraction. Both of these methods yield information concerning the actual arrangement of the atoms in the metal as well as their spacing, so that the crystal structure is revealed almost as clearly as if we could actually see it. These methods also tell something of the grain size, even though it is too small to be seen at the highest magnification possible in the microscope. X-ray and electron diffraction reveal how the crystal faces are arranged, whether they are distorted, and whether the deposit is under stress. It is therefore possible in this way to study the effect of varying the conditions of electrodeposition with a minuteness not otherwise with

our reach. A description of a number of such studies may be found in the discussion held under the auspices of the Faraday Society a little over a year ago.

The structure of an electrodeposit is determined by the conditions that prevail at the interface between the solution and the cathode. Two things are important: the crystal structure of the base metal, and the composition of the solution at the interface. The last may be considerably different from the composition of the bulk of the solution. The pH is sure to be higher at the interface and the metal content lower. The composition of the solution in the interfacial film is influenced by current density and by agitation of the solution. High current density tends to make the composition of the film more unlike that of the bulk of the solution, while agitation has the opposite effect. The density and viscosity of the solution influence the thickness of the film.

If substances are present which lower the surface tension, as most of the commonly used organic addition agents do, they tend to become concentrated in the film next to the cathode so that their effect is magnified. Surface tension is directly connected with hydrogen overvoltage so that there is a relation between surface tension and pitting.

The mechanism by which the structure of a deposit is determined is in the film. It is only by studying the two together we may hope to arrive at an understanding of the fundamentals of electrodeposition.

METAL FINISHING PRACTICE

By W. M. PHILLIPS

Chemical Department, Research Laboratories Section, General Motors Corp., Detroit, Mich.

THE year just passed has in the retrospect much to commend it in regard to advances made in the production of improved metal finishes. The millennium has not been reached or, I should say, even approached, but very distinct improvements have been made. For one thing, our efforts have assumed a directional tendency, which should in years to come produce even better results.

Metal finishes, to be successful, should have two outstanding qualities. First, they must be durable for the purpose intended. Next, they must be attractive in appearance. Initial good appearance is nothing new; but one only has to look these days to see that there has been great improvement in the appearance of the finish on metal parts. This is true of both organic and inorganic finishes. By organic finishes we mean paints, lacquers, enamels, and the like. By inorganic we mean such finishes as are produced by electroplating, or metallic surfaces obtained by other means.

Before any finishing is done at all it is first necessary to select the proper metal from which to make the object intended, and in this regard there is a much wider choice of high quality materials than in past years. This applies to both ferrous and nonferrous metals. There has been of late quite a development in the furnishing of steel sheets and strip coated with metals ready for use. There have also been available steel sheets of high finish, and, by means of improved fabrication, the amount of polishing has been lessened. There have also been improvements made in corrosion resistant steel, generally known as stainless steel, or rustless iron. In the non-ferrous field there has been quite an advance made in the type and variety of material available. Zinc base die castings are being used more extensively than ever before in the automotive trade due to two causes: one, the basic improvement in the quality of castings themselves, and, the other, the great advance in the electroplating of this type of material. In the years past it was impractical to use many zinc base die castings for outdoor use, due to the fact that they could not be satisfactorily electroplated.

The work of the American Electro-Platers' Society, the American Society for Testing Materials and the National Bureau of Standards in finding out what the requirements were for plating steel has greatly enhanced the quality of parts made in accordance with the resultant specifications. On a recent investigation of groups of parts plated in 1935 and a similar group plated in 1936 there was found an improvement of 27%. This improvement represented an increase of 27% in the thickness of plate applied. From the tests made by the above mentioned societies it has been proved beyond all doubt that there would be at least that much improvement in corrosion resistance in outdoor service. There has been a better understanding in regard to the processes of electroplating. There is now a tendency toward putting on the plates in a smooth or bright condition, which when developed may eliminate a part or all of the buffing cost and improve the quality due to the fact that metal is not removed from sharp corners and angles, as is the case when buffing is depended upon entirely for obtaining a desirable appearance.

In the paint, lacquer and enamel field there has been a much better conception of pretreatments before the application of organic films. Certain rust inhibitive processes have been very useful, and in many cases have improved resistance to corrosion over 100%.

It is not to be understood, of course, that all of these developments have been made in 1936, but great progress has been made in them; and, as we remarked in the introduction, there has been a directional tendency toward the following things:

1. Heavier electroplating.
2. Better base metals.
3. Better surface on the base metals.
4. Rust inhibitive treatments.
5. Better paints, enamels and lacquers.

THE ELECTRO-PLATING INDUSTRY

By Dr. WILLIAM BLUM

National Bureau of Standards, Washington, D. C.

IN any industry, important advances generally occur only at long intervals and may not then be immediately recognized. The greatest progress is usually made during the intervening periods, when the new methods are being tried out, modified, and correlated with the needs of industry. Plating in 1936 represents one of these intervening years, in which, as above defined, progress has been real, though not spectacular. The principal activities include at least three important phases of the industry.

1. **Bright Deposits.** The industrial use of bright nickel and zinc deposits has been extended, and some of their original limitations have been overcome. One serious obstacle to their evaluation and standardization is that many of them are still considered as "secret formulas." Until these are fully disclosed through patents or other publications, the practical plater may well fear that the industry is going back ward toward that age of secrecy from which th American Electro-Platers' Society has done so muc to elevate it during the past 25 years.

2. **Standardization and Testing of Deposits.** Both in Federal and commercial specifications, serious consideration has been given during the year to details o testing methods, particularly of those for competing materials, such as plated and hot-dipped zinc coatings. Even though such questions appear at times to be controversial, they are encouraging signs of an increased demand for quality, and of a need for simple, reliable tests, especially of local thickness.

For the latter purpose, S. G. Clarke[1] has made a valuable contribution in his "jet" method, especially for nickel coatings. A. Brenner has developed a new, non-destructive, magnetic method for measuring the thickness of nickel coatings on non-magnetic base metals. This was described to the Philadelphia Branch of the A.E.S. on November 21, 1936.

The exposure tests of plating on non-ferrous metals are in progress. While it is premature to draw conclusions, the results will no doubt be useful in formulating specifications for plating on non-ferrous metals.

3. **Large Scale Plating of Wire and Strip.** The opening of a new "Bethanizing" plant at Johnstown, Pa., indicates that this type of zinc plated wire is filling a definite need. The exposure tests of coated wire that have just been started by the A.S.T.M. will no doubt furnish valuable information upon the protective value of this and other types of zinc coatings.

The reported application of tin plating to strip steel by the Crucible Steel Company will be watched with great interest. If electroplating can compete in price and quality with hot-dipping of tin or zinc on wires and sheets, the total area of metal electroplated annually may be enormously increased.

The above and other interesting developments show that the metal fabricating industries as a whole are alive to the possibilities in the electrodeposition of metals, and to the need for research in both scientific and industrial laboratories. "The best is yet to be."

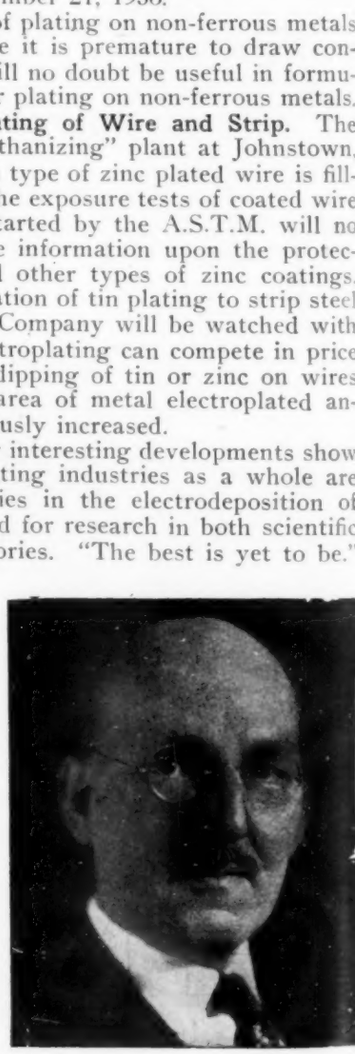
Photo, Courtesy International Nickel Company, New York

Plating with nickel 0.03 of an inch thick on the worn interior made impossible to replace this 9½ ton hydraulic cylinder in service at a fraction of the cost of a new cylinder

ELECTRO-PLATING PRACTICE

By GEORGE B. HOGABOOM

Hanson-Van-Winkle-Munning Co., Matawan, N. J.



THE interest taken in electrocleaning and the electrodeposition of metals by the steel industry presages an advancement in electroplating, the limits of which no one can predict. In 1935 we saw wire electroplated with zinc at 1,000 amperes per square foot. 1936 has seen the beginning of electroplating of strip steel stock on a large production basis. The goal is to deposit zinc, tin, or copper with a definite weight

of metal per unit area, at speeds up to or even more than 120 feet per minute. It will be done.

The value of electrocleaning strip steel stock before annealing has been proved and will soon become the regular practice in all steel mills. It has been recognized that better surface conditions can be had, especially when the steel is "bright" annealed. It is predicted that the carbon residue that remains on steel after immersion acid pickling will in the near future be removed electrolytically, previous to any subsequent rolling operation. The electroplating industry hails better steel.

The deposition of bright nickel has come to stay.

The introduction of what are considered rare metals, e.g., molybdenum, selenium, cobalt, etc., in plating solutions and anodes in minute quantities, suggests new possibilities in improving electrodeposited coatings. Some courageous investigator may find that the addition of radium to an anode may replace generators, or even the rectifiers our British cousins have reported to be so efficient!

Electroplating marches on!

PRACTICAL PLATING ADVANCES

By JOSEPH P. SEXTON

Sargent & Co., New Haven, Conn.

THE electroplating practice is continually advancing; there is absolutely no ceasing in its activity, each year shows more progressiveness, more enthusiasm, and the aim is always onward. The year 1936 was no exception. Many new formulae, processes, and items of equipment were produced to make more uniform and better plating, and insure products that have appeal and durability.

The corrosion tests of plated metals being carried on under the direction of the Bureau of Standards at Washington, D. C., are responsible for establishing specifications for plated deposits, which necessitates more accurate control of solutions, better throwing power and current distribution, and in many cases different proportions and compositions of the plating bath. Better cleaning and understanding of the metal to be plated is required, and this has meant the adding of many new materials to the list of cleaning agents, and also improvements in the degreasing and other methods of cleaning. The need of measuring the thickness of deposit is important and has resulted in newer processes and instruments being produced for this requirement. The demand for better and brighter deposits of nickel, cadmium and zinc, has been stressed, and solutions of different composition, alloy solutions, and many brightening agents that give excellent results have been produced.

The same is true of chrome plating, where better throwing power and harder deposits are required. Some new chrome solutions, differing from the sulphate bath, are on the market with very good results claimed.

Many new formulae for the coloring of metals by electroplating have been produced, including coloring of gold. New chemicals for black coatings and rust proofing on iron and steel, and many new materials have been discovered that improve the color and effect of lacquers and enamels.

An electro-chemical method for producing bright surfaces on aluminum, preventing tarnish and giving the surface high reflectivity, has been added to the list of anodic finishes on that metal. Improvement in the deposition of rhodium has been made, and experiments on the rapid deposition of iron, at the Bureau of Engraving and Printing, have shown results. Also experiments showing the possibilities of depositing such metals as bismuth, tellurium, rhenium, arsenic, manganese, iridium, and others have been carried on at some of our universities.

The electro-pickling of iron and steel has been bettered, new stripping agents developed, and an electrolytic process for polishing metallic surfaces, for which better results than with an abrasive are claimed.

Some new compositions for plating baths, on account of health hazards, and other reasons, have been recommended; such as silver iodide instead of silver cyanide, etc.

Satisfactory coatings for plating racks are obtainable; cement instead of glue is being introduced in dressing polishing wheels, and of course the equipment also has kept pace with the other developments. Many new automatic plating machines and barrels, lathes, rolling barrels, washing machines, etc., have been produced to expedite production, and save cost and labor. I know there are many other advances that I have failed to mention, and am sure that to this list will be added many more in 1937.

RHODIUM PLATING

By SIGMUND COHN

New York.

THE use of rhodium as an electroplate has greatly increased during the current year. There have been some new uses developed for the metal; however, generally speaking this increase has been due to improved business conditions and greater demands for rhodium plated goods.

One notable condition during the year has been the steadily advancing price; the price per gram in hundred gram units having advanced from $2.66 at the end of 1935 to the current price of $4.05 per gram for the same quantity. It is interesting to note that this advance in price is the only substantial change which has been made in the last three or four years, the price previously having remained practically unchanged. During the same period most other commodities and particularly metals have advanced at least as much in proportion; the advance in rhodium, however, followed that of other metals after a period of several years. In other words the cost of rhodium plating an article is today no larger a proportion of the cost of the finished article than it was several years ago.

In spite of this advance in price the sale of rhodium has definitely increased, and it is anticipated that at the present price level which now appears to be stable, there will be no reduction in the consumption of rhodium due to its increased cost. In other words the buying public definitely appreciates the inherent excellent qualities of rhodium and is demanding goods with this finish even at advanced prices. This is in line with today's economic trend throughout the Country.

The consumption of rhodium during the current year indicates in a very definite manner that rhodium is no longer a new "novelty" plate, but is one of our permanent finishes here to stay. Its characteristics are well known both to the manufacturer and ultimate consumer, and it is being used on an ever widening variety of articles. It is even being used by some manufacturers of platinum diamond jewelry who recognize that rhodium has an even whiter color than platinum itself.

During the year 1936 the quality of rhodium electroplating solution has been greatly improved. While there have been no basic changes, these improvements have been in the nature of refinements and of the utmost importance to the manufacturer who is today able to obtain a whiter, more brilliant and more corrosion resistant deposit than formerly; and at the same time a solution easier to use and operate.

There have been several interesting new scientific uses for rhodium developed during the current year. In the radio tube industry it has been found that rhodium plated electron emitting surfaces have very much higher efficiency than those which are not so treated. It has also been found that certain types of mercury vapor lamps used for ultra-violet work can be greatly improved by the use of rhodium. Science is experimenting in many fields in the use of this relatively new electroplate which has so many exceptional properties.

RUST PROOFING

By GUSTAF SODERBERG
Technical Director,
The Udylite Co.,
Detroit, Mich.

CONSIDERABLE advance can be noted in the field of rust proofing prior to painting both industrially and technically. Quite a few new installations have been made and the volume of materi used has increased some 25 to 30%.

Sprayed phosphate coatings have been improved quality as well as in ease of producing them. T time required for processing has been decreased ½-1 minute which involves saving in space and i vestment. Operating temperatures have been brough down from 210°F to 180°F producing savings in hea Less concentrated solutions are used than in imme sion processes.

One company is making ready to market shortl a sprayed phosphate coating process which it expect to give even greater rust resistance than heretofor has been possible.

A new immersion process for applying phosphat coatings has been developed which is particularly suitable for hot rolled and oxidized steel which previ ously has required particular care and attention.

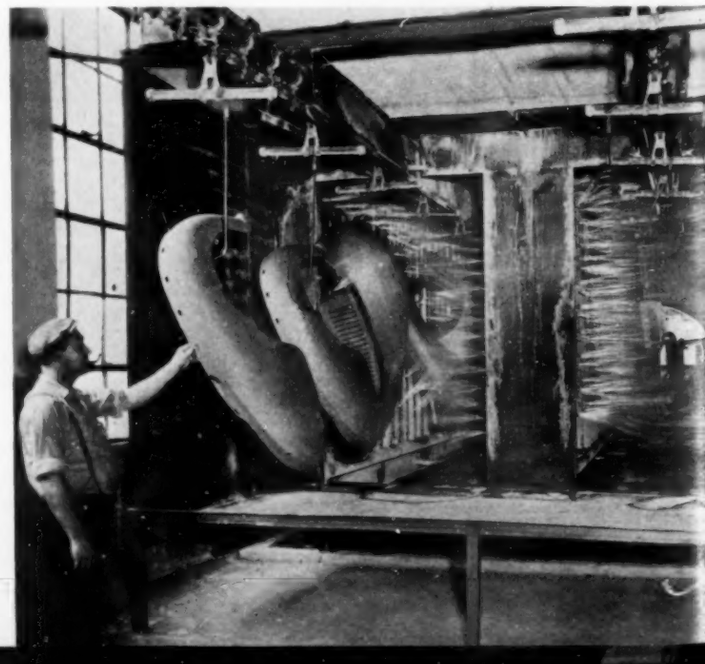
No new chromate coating processes have been de veloped during 1936.

The use of these processes has been extended t include treatment of a considerable volume of ho galvanized and galvannealed surfaces and of zinc bas die castings.

As far as metallic rust protective coatings are con cerned, it is noted that the several bright zin plating processes have been improved during the yea While making use of different addition agents the are now quite well in agreement as far as metal cyanide and caustic contents are concerned. Som advance has been made in barrel plating with brigh zinc. While a considerable amount of bright zin plating is now being done, many companies hav found it more economical to lessen their brightnes requirements and therefore operate their solutions t give ordinary white zinc plate.

The use of Bethanized wire, heavily zinc coated i acid solution at high current densities, has increase rapidly. A second installation is now in operatio and others are contemplated. Work has been don to increase the current densities employed sti further.

The volume of conduit, etc., which is acid zin plated at ordinary current densities has increased wit increasing construction activities. The tendency t ward use of higher current densities is manifest als in this field.



Sheet metal parts and Buick coil springs are here shown entering a spray booth in the new system now in operation in the sheet metal plant of the Buick Motor Company. Only one minute is required for the processing with this installation as against five and one-half minutes for the former dip method. One thousand nozzles in this booth are supplied by two 1,000 gallon per minute pumps under a pressure equivalent to a 50-foot head

METAL COLORING PRACTICE

By Dr. C. B. F. YOUNG

Consultant; Instructor, Columbia University; Lecturer, New York University, New York.

METAL coloring, as such, is rapidly assuming its proper place in the metal industry. This important phase has been developed by rule of thumb methods, and has lead to uses of solutions which are very wasteful. The Bureau of Standards has conducted some very important research with black nickel solutions resulting in the adoption of the acid baths instead of the basic solution formerly used. Black nickel is being used more and more at the present time for industrial finishes. True, it must compete with lacquers and japans but this is leading to research which may develop better solutions.

A rather interesting research problem is being investigated which concerns a new dip bath for producing a smooth, hard, blue black deposit on brass. An announcement possibly will be made shortly in regard to this process.

Another new development which has taken place in the year just closed is one for coloring almost any base metal. By using the electric current it is possible to obtain organic metallic coatings of almost any color or shade. The coatings are very attractive and can be applied on articles of any shape and size.

It is quite possible to color metals using a metallizing unit of the spray gun type, using acetylene, oxygen and the metal or alloy being sprayed. It melts the metal or alloy and throws it on the base metal in the molten state. The color depends upon the stock fed the machine and produces a mottle finish. The author has a steel strip which has been plated with copper, brass, bronze, aluminum, chromium, nickel, steel, and tin. The colors are rather attractive and a bright future is predicted.

Metal coloring is in its infancy and much research is needed to perfect new methods. Aluminum which has been oxidized and then dipped into organic dyes has attracted much attention. This is an interesting process, but has the fault of color fading. Research is being conducted to produce inorganic colors which hold some promise of producing results. With all the colors of the inorganic field, it does seem possible that some of these can be adapted.

COATING MATERIALS FOR METALS

By Dr. FRANK A. STRAUSS

Barsky & Strauss, Inc., Consulting Chemists & Chemical Engineers, New York, N. Y.

THE increasing use of new materials has been the principal trend in paint, enamel and lacquer development during the past year. The finish maker has been quick to take advantage of the latest chemical advances, and has embodied in his products a wide variety of new synthetic ingredients. Some of them will be described briefly.

New urea-formaldehyde resins, hitherto used principally as molding plastics, became commercially available in 1936 in soluble form for coating purposes. By blending them with nitrocellulose or alkyd resins, finishes outstanding in hardness and color stability are obtained.

A new heat-hardening phenol-formaldehyde resin, for high bake metal coatings where exceptional chemical resistance is required, has been announced.

In the alkyd resin field, high gloss white enamels which, it is stated, may be baked at temperatures as high as 320° F. without discoloration have been placed on the market.

The vinyl resins have found new uses where chemical resistance or color stability are necessary. An interesting application of a resin related to this class is in a new plating rack varnish of superior protective value.

Improved nitrocellulose of extremely low viscosity but having good mechanical properties has been used in a new type of high solids lacquer. This permits a finish of adequate thickness to be produced with fewer coats.

Recent developments in light metal alloys have challenged the finish manufacturer to meet the difficult problems of protection against corrosion which have arisen. Further progress along this line has been made during 1936. Improved synthetic resin primers containing the chemically protective chromate pigments are now available. This is of great importance to the airplane industry where the insidious intercrystalline corrosion of light metal alloys is an ever-present menace.

The expanding use of zinc-base die castings presents a different type of problem to the coatings chemist. Here most finishes fail through lack of adhesion. Recent investigations have led to a better understanding of the factors which cause this trouble, and better finishes have resulted. The adhesion of lacquers to chromium plate has also received attention, and several manufacturers have placed new products on the market for this purpose.

A number of interesting decorative and novelty finishes have been announced during the past year. Among them are a two tone spatter or "marbleized" effect, which can be applied without special equip-

ment or lapse of time between coats. A wrinkle or shrivel finish which gives a uniform pattern when baked at any time up to 24 hours after application is another novelty. A flock fiber producing an attractive silky flock or "suede" finish made its appearance recently.

The examples mentioned are merely the high spots of the year's developments in metal finishes. From them, however, it may be seen that progress during 1936 has not lagged, and it may be predicted that 1937 will see further important advances in the finishing art.

THE JOB OR CONTRACT PLATING INDUSTRY

By HENDERSON BELL, III

Chromium Corporation of America, Cleveland, Ohio.

THE year 1936 marks a real milestone in the history of job electroplating. It marks the beginning of the end of the period in which electroplating was looked upon as one of the black arts with the plater as the High Priest of the Magicians. No plating solution was thought to function properly unless it contained the proper amount of tobacco juice of the particular brand which the plater happened to like and a great discovery was that he could change his brand without effect upon the solutions. Another characteristic of this period was that plating was considered a necessary evil and was such a dirty sloppy operation that it must be located in the dirtiest and darkest corner which could be found. The management never considered it as an important and integral part of the plant, and therefore the Magician ruled supreme.

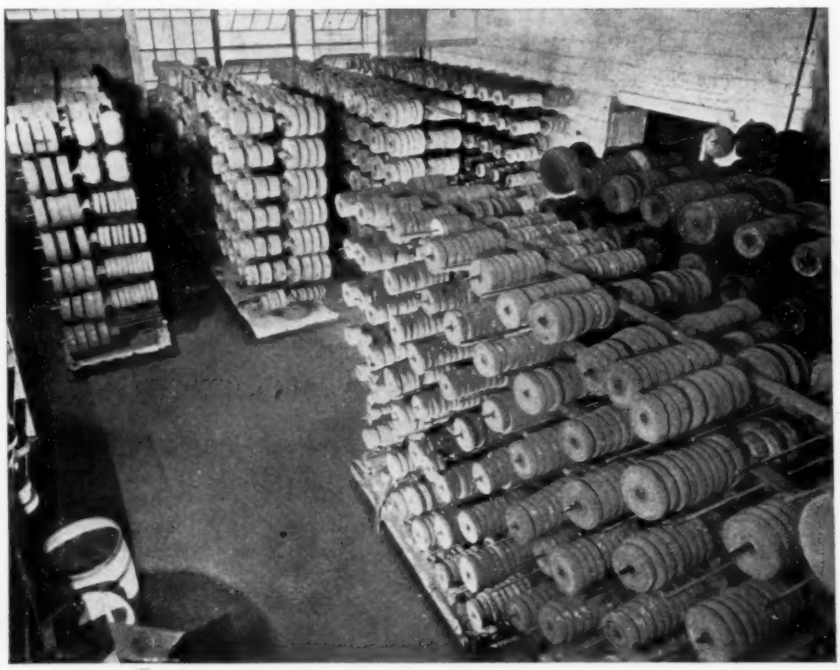
Then Science got to work and organizations such as the American Electro-Platers' Society began to bring the art into the open. Today most of the large users of plating have adopted specifications governing the quality of the plating which they buy and many of them will not let out their plating unless and until the bidders shop has been inspected and approved by their Engineering Departments.

The A.S.T.M. in conjunction with many other technical societies has also set up tentative specifications for electro-deposited coating which should serve as a guide to all users who do not have their own specifications.

Specification plating has finally emerged from the old art and scientific plating has been born. The Chemist is replacing the Magician and will do so more and more. He is here to stay and specifications will become more rigid and be more rigidly enforced.

The progressive job or contract platers, mostly the latter, have seen the handwriting on the wall and have realized that it is impossible to do specification plating without modernizing their plants. They have therefore been busy this last year installing laboratories and hiring chemists; insulating and lining plating tanks and racks; increasing and modernizing their generator capacity; providing more and better rinsing tanks; providing agitation and heat for their tanks; providing for continuous filtration or frequent filtration of the solutions; overhauling or setting up more modern polishing and buffing equipment; cleaning and painting their plants; providing adequate light and ventilation. These progressive companies have thus spent a great deal of money, not because they wanted to, but because they knew that if they were not able to furnish the quality of plating which the customer demanded, he would go to someone who could produce it or he would put in his own plating equipment.

Your customers are going to demand better and better plating. Your present plant is not able to produce it. Whether you lose your business and investment is in your hands. Wake up, get in step with the times, and fight for your business. Realize that the dark ages are gone and let your slogan for 1937 be "MODERNIZE MY PLANT."



Drying Polishing Wheels. It is important to control temperature and relative humidity

A Calendar of Events of Importance to the Metal Industries

1936

JANUARY

Aluminum industry celebrates the 50th anniversary of the discovery of a commercial process for producing this metal by Charles Martin Hall.

Cadmium metal rises to over a dollar a pound.

FEBRUARY

Annual winter meeting of the Institute of Metals Division, A. I. M. E., featuring metallography, aluminum metallurgy and theoretical metallurgy.

Industrial activity fair and steady.

Veterans' Bonus Act Passed.

MARCH

Annual meeting of Standing Committees of the American Society for Testing Materials including a Conference on Electroplating Specifications.

Industrial operations gain slowly.

APRIL

Bethlehem Steel Company formally opens a new mill for electrogalvanizing round wire—"Bethanizing"—by the Tainton process.

Electrochemical Society meeting. Papers on inhibitors, beryllium copper, plating of copper, nickel, cobalt, manganese, thallium and aluminum.

Copper rises ¼ cent to 9.50c per pound electrolytic.

MAY

Twenty-fourth Annual Convention of the American Electro-Platers' Society. Papers on all phases of electroplating, polishing and finishing.

Master Electro-Platers' Institute of the U. S. dissolved. Three local associations continue to function actively: Midwest, Chicago and New York.

Fortieth Annual Convention of the American Foundrymen's Association. Special sessions on non-ferrous foundry subjects.

Industrial activity rising, led by steel and automobiles.

JUNE

Thirty-ninth Annual Meeting of the American Society for Testing Materials. Papers and reports: radiography and x-ray diffraction methods; corrosion, exposure tests of plating on non-ferrous metals, lead alloys, copper alloys, light metals and alloys, die cast metals and alloys.

William J. R. Kennedy elected first Executive Secretary of the American Electro-Platers' Society..

Patman-Robinson Act Passed.

JULY

Platers' Guide merged with Metal Industry.

Copper rises ¼ cent to 9.75c per pound electrolytic.

Cadmium shows signs of slipping, large quantities being contracted for at 75c per pound.

Industrial activity improving steadily.

AUGUST

Death of Edward Weston, inventor, who perfected the electric dynamo.

Copper firm at 9.75 with sales reaching a record total of 175,484 tons.

Platinum skyrockets from $37 per ounce to $62.

Industrial activity continues improvement; seasonal recession less than normal.

SEPTEMBER

Symposium on New Metals and Alloys Applicable to the Chemical Industry at meeting of the American Chemical Society.

General Motors wins on appeal in patent suit brought by United Chromium, Inc., for infringement of Fink patent.

Platinum continues skyward going to $70 per ounce.

OCTOBER

Eighteenth Annual National Metal Exposition and Congress. The largest registration, program and exhibit of equipment in history.

Seventieth Electrochemical Society meeting. Papers on electrodeposition of alloys, molybdenum, porosity tests.

United Chromium Inc. granted petition for a rehearing and reargument against General Motors.

Industrial activity continues gain.

Copper rises ¼ cent to 10c per pound electrolytic.

Platinum falls to $48.00 per ounce.

NOVEMBER

President Roosevelt re-elected.

Copper rises ½ cent to 10½c per pound electrolytic. Zinc rises to 5.05c Prime Western E. St. Louis. Tin rises sharply, several cents, to 52-54c per pound Straits. Lead rises rapidly to 5.05c per pound St. Louis.

Industrial activity at the highest level since 1929 and 1930.

DECEMBER

Copper rises 1½ cents to 12c per lb.

Zinc and lead continue upward trend, rising to 5.45 and 5.85 respectively.

General Motors wins in re-argument before Circuit Court of Appeals against United Chromium, Inc.

A Review of 1936—Prospects for 1937

WHEN 1936 began, we had left behind a year of strain and uncertainty. Were we emerging from the depression or were we not? No one could tell. Business was bitterly opposed to the Administration. We were worried about the possibility of currency inflation. We were worried about the imminence of war in Europe. Business was improving, slowly, but hesitating. We were facing a Presidential election year.

Nevertheless, sentiment was optimistic.

What actually happened?

Metal Prices

THE major non-ferrous metals—the foundations of our industries—had a very good year. Copper rose by slow stages from 9¼c per lb., to 10c by October, and then rapidly gaining momentum, to 12c by December 31st. Zinc, beginning the year at 4.85c per lb. Prime Western, E. St. Louis, remained practically unmoved until October, then began a rapid rise and closed the year at 5.50. Lead, starting out at 4.35c per lb. St. Louis, pursued a hesitant path for months, but during the last quarter climbed with increasing speed, reaching 5.85. Tin, always more speculative, began the year at 47c per lb. Straits, see-sawed up and down, going as low as about 42, and during the last half year gained steadily (at times rapidly) rounding out the year at its highest level, about 52. Antimony, another volatile commodity, put in a moderately quiet twelve months. After a drop at the beginning, from 14c to 13c per lb. (Chinese) it swung between that figure and 12, seeing the old year out 13.75.

Aluminum at 20.50c per lb. and nickel at 35c per lb. electrolytic, were unchanged.

Silver, formerly a high flyer, spent the year very much in the doldrums after its exciting career in 1935 and its decline from 81c per ounce Troy down to 49¾, then to 44¼, where it remained until October. Then a little flurry occurred, sending it up a cent. The year ended with the metal at 45c and quiet.

Platinum, after sinking gradually from $36 to $30 per ounce Troy during the second quarter, suddenly attracted the attention of speculative interests. These, together with the improved industrial and jewelry demand blew the price up to $70 in September. By December, however, the excitement had subsided, the fever had receded and also the price of the metal, to $45-$48.

On the whole, the year 1936 was good for metals; good in varying degrees and perhaps with an exception or two, but still good.

Technical Developments

IN THE technical methods and processes of the metal manufacturing and finishing industries, the year showed improvement, not in any revolutionary developments but in steady progress.

In copper alloys there was a decided increase in the use of copper-nickel mixtures, aluminum bronze, copper-silicon, and copper-beryllium alloys. It is reported also that the addition of small amounts of tellurium and selenium have been found to improve the machineability of copper alloys.

Lead is finding a new outlet in metallic paint. The use of lead-tellurium alloys is growing. A most important step was the promulgation of the Seal of Approval by the Lead Industries Association to be used by manufacturers of products which meet the standards of the industry.

Magnesium took a long step forward with its adoption for use in a vacuum cleaner in a number of die cast parts.

Platinum is finding new uses in the chemical industries, in platinum-clad reaction vessels.

Nickel, whose expansion in output was one of the features of the year, grew partly by the increase in general activity, and to a great extent also by the increased recognition of its value in a variety of industries. The consumption of aluminum increased greatly in the same fashion.

In the ingot metal industry there was a clearly defined trend toward closer metallurgical control and more uniformity of output. The problems of this industry are growing more complex due to the increasing number of alloys and the consequent increased number of "impurities" in the scrap caused by the use of small quantities of special addition agents.

In the foundry same tendency was clear—closer temperature control and in addition, closer control of sand. Numerous foundries report a much greater use of the hardenable copper alloys with silicon, nickel, etc.

The die casting industry enjoyed a banner year, not only because of the general improvement in business but because of the development and perfection of methods for making larger and larger castings at higher speeds than ever before in its history. Another advance of considerable importance was the use in commercial manufacturing practice, of magnesium base die castings and this practice bids fair to grow rapidly. Pressure casting of brass is steadily extending its scope.

Silverware manufacturers report improved practice in the working of nickel silver. They also report progress in the standardization of the thickness of the silver plate.

The metal finishing industries were fully alive to the need and opportunities for improvement. New chemicals have appeared for degreasing and alkaline cleaning. New phosphate coatings are reported for rust proofing. The polishing industry is showing a real interest in the use of cement instead of glue for binding abrasives. New types of protective coatings for plating racks have come into the market.

A corrosion resistant coating has been developed for zinc base die castings. A process has been devised for the deposition of pure manganese. Colored electrodeposits are definitely approaching wide commercial use. A new process has been announced for the production of bright aluminum surfaces, suitable for reflectors. An event of great importance was the formal opening of the large mill of the Bethlehem Steel Company for automatic zinc plating of round wire. The Crucible Steel Company is going ahead with a project of tin plating strip by electrodeposition.

The Bureau of Standards is carrying forward its research project sponsored by the American Electro-

Platers' Society on coatings for non-ferrous metals which, when completed, will provide data for specifications like those which have been prepared for coatings on steel.

Bright nickel deposits have become increasingly popular. They are generally recognized as commercially practical and labor saving.

Rhodium plating has found new outlets in radio tubes and in mercury vapor lamps.

Coating materials such as lacquers improved markedly. Synthetic lacquers are more widely used and a number of new novelty effects have appeared such as marbleized finishes, two-tone spatters, etc.

The general tendency throughout the metal finishing industry is clearly upward: heavier plates, better base metals, better base metal surfaces, improved rust inhibiting treatments and improved paints, lacquers and enamels.

Economic Developments

THE outstanding general economic feature of the year can be summarized in two words—"Improved Business." That these two words could summarize the whole story, in spite of a Presidential election, in spite of business opposition to the Administration, in spite of continued Government deficits huge in size, in spite of fears of inflation within and wars abroad, proves the fundamental soundness of our national economy. Not only did consumers' goods improve (recovering 54% of the 1929-32 decline) but also producers' goods, which recovered 58% of the 1929-32 decline. Unemployment, estimated by the National Industrial Conference Board, at 16,000,000 in 1933, and about 9,200,000 late in 1935, has receded to 8,700,000.

The general improvement was reflected in our industries. The rising metal prices summarized above are prime examples. Ingot metal deliveries and unfilled orders, as reported by the Non-Ferrous Ingot Metal Institute, have risen from about 6,000 tons per month and 16,000 tons, respectively, toward the last of 1935, to 7,800 and 30,500 tons, according to latest reports—an excellent index of the improvement in casting plants. The copper and brass mills are operating at from 70% to 95% of capacity. Electrical manufactures can be gauged by the orders of the General Electric Co., 37% higher than in 1935, and sales by the Western Electric Co., 33% up. Railway purchases in 1936 increased 80% over 1935. Automobile output needs no figures to describe it. Its improvement has been too apparent. The building industry took 15,000,000 pounds more copper and brass pipe and tube than ever before in its history. Jewelry sales were 22% over 1935 and 41% over 1934.

The inter-metal competition has grown to such a point that it has assumed the proportions of an industrial race. Copper, nickel and aluminum are competing hotly with each other (and of course with stainless steel) for markets. All have made great progress because all are being energetically pushed by research and commercial exploitation, and their prosperity is due in no small measure to the activity of their sponsors. Zinc has taken an enormous stride in the die casting industry and the uses of rolled zinc are also increasing. Lead is looking forward, although its spread has not been so spectacular. Silver and platinum are receiving attention for wider industrial use.

The litigation over the Fink patent on chromium plating continued. General Motors carried its case as defendant against United Chromium, Inc., to the Circuit Court of Appeals and in September the Court rendered its decision, reversing the Federal District Court decision and thereby declaring the Fink patent invalid. A rehearing and reargument was held shortly afterward with no change in the decision.

Prospects for 1937

AND now, having absorbed a good year, having weathered the actuality of a Veterans' Bonus, the fear of inflation and the fear of a wide European war, for a year at least, we turn again to the future. What can we see ahead?

Technically and scientifically the prospects are encouraging. No one can foresee revolutionary inventions, but many improvements and refinements are on the horizon. The rolling mills are actively working on the rolling of sheet directly from the molten metal. Metal finishing is spreading to include color plates, electrodeposition on steel strip and wire and new and original lacquer and enamel coatings.

Economically, the immediate future seems bright. The large consumers of the products of our industries are optimistic. Automobiles look forward to a 5,000,000 unit year. Building estimates that 435,000 new housing units will be constructed, and this is close to "normal." The electrical industries look forward to continued improvement. Railroad freight traffic should increase and bring with it increased railroad buying.

Since the metal industries follow the general trend, our prospects are cheerful. They are far from being certain, however. We have soft spots within our ranks. The brass foundry still badly needs a "spark plug," all the more since the pressure casting of brass has become commercially practical and is spreading steadily. The jobbing electroplating industry is still subject to far too much under-priced competition.

Viewing the horizon broadly, there are many threatening clouds. War in Europe seems to be more and more imminent. Our National Budget is still far out of balance. Our public debt is growing steadily and has assumed fantastic proportions. Our ranks of unemployed are still far too numerous. We are still not out of danger of inflation. Labor difficulties on a nation wide scale threaten the automobile industry.

We are better off than we have been since 1930. The outlook for the coming year is promising. But we must remain watchful.

Apologia

Due to the extended space devoted to the Reviews of a large number of special fields in our industries, it has been necessary to omit some of our regular features, such as the Shop Problems, Practical Brass Foundry Abstracts, News from **Metal Industry** Correspondents, etc. In several other Departments only the news of immediate importance has been included.

We assure our readers that beginning with our February issue, these Departments will again be represented, as usual, in full strength.—Ed.

Modern Equipment

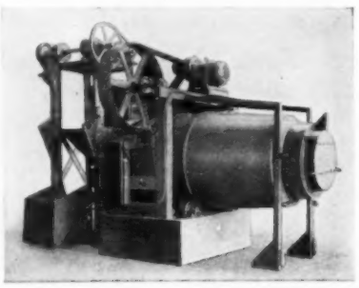
New and Useful Devices, Metals, Machinery and Supplies.

Tumbling Mill

The Cascade Tumbling Mill made by N. Ransohoff, Inc., W. 71st Street and Millcreek, Carthage, Cincinnati, Ohio, is made in two types—the end loading and side loading type.

They are used as exhaust mills for handling iron and steel castings and also as water mills in handling brass castings. For brass the machines are equipped with a drain so that the water can be run through the mill to rinse the castings and carry off the sand during the tumbling operation. Crucible droppings are used for tumbling material and since the tumbling material is handled automatically enough of it can be used to completely submerge the work so that the parts are floating in the tumbling material. This it is claimed, results in very rapid and thorough cleaning.

The automatic handling of tumbling material is an exclusive feature of the mill and one that is claimed to reduce labor costs phenomenally. The work is charged into the mill by a power loader. Reversal of direction of rotation, when cleaning is completed, discharges the work at the end of the screen. Tumbling materials are separated from the work



Cascade Tumbling Mill

and fall into a cone shaped jacket surrounding the screen. When the mill is again rotated in tumbling direction, the cleaning materials automatically return to the tumbling compartment. Elimination of all manual handling of cleaning materials is said to speed operations and to reduce cost.

New Abrasive Mask

The MSA Abrasive Mask, a recent development of the MSA Dust Research Laboratories has just been announced by the Mine Safety Appliances Company of Pittsburgh, Pa. The new mask, lately placed on the market, is a lightweight comfortable unit for giving complete protection to the wearer from the heavy concentrations of fine dust present in shot and sand-blasting rooms. It is said to be sturdily constructed and able to withstand the impact of high-velocity abrasives; that its protective efficiency and durability has been thoroughly tested and proved by months of service on both shot and sand-blasting work.

Air is fed into the face-piece through a corrugated rubber tube which permits free movement of the head. The incoming air enters the lower part of the face-piece and passes out through double exhalation valves, whose extremely low resistance to the air flow permits low pressure in the face-piece and assures an ample supply of air.

A latex-covered silk hood fits neatly over the head and shoulders of the operator and fastens at his waist, exposing only the lens section of the face-piece.

The air passing out the exhalation valves from the mask serves to inflate the hood slightly, providing an air-cushioning effect which increases the natural resistance of the fabric to the wearing action of the shot, or sand. The hood is removable and replaceable, being attached to the face-piece with readily-opened fasteners.

MSA Abrasive Mask

The MSA Abrasive Mask has a Flow Control Valve with a "bump-proof" adjustment. The setting cannot be changed accidentally, since the handle is normally held in a released or "free-wheeling" position by means of a spring which must be pushed in by the operator to an "engaged" position and then turned to change the flow of air.

In the event the air supply should fail, or become unusable, for any reason, a lever extending over the air-supply nipple of the Flow Control Valve immediately detaches the mask from the air line when pulled upward by the operator. This enables the operator to break his connection and breathe through

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Non-Lubricated Compressors; for special process work where the presence of lubricating oil in the compressed air supply is objectionable. Sullivan Machinery Co., Woodland Ave., Michigan City, Ind.

High Speed Double Seamer; with a non-spill can feed and marking device. E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio.

Quiet Operating Vertical Type Unit Heater. The Trane Co., La Crosse, Wis.

Metal Cutting Tool; 9X "Scroll Pivoter" snip. A shear, which pivots as it cuts. J. Wiss & Sons Co., Newark.

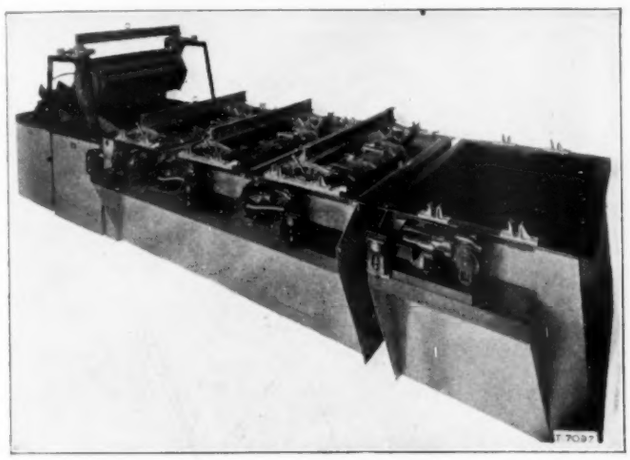
New Regulators; a series of three new regulators providing accurate oxygen and acetylene regulation through the entire range of welding and cutting operations. The Linde Air Products Co., 205 E. 42nd St., New York.

the filter on the free end of the corrugated tube, and leave the confined space.

If desired, a replaceable charcoal cartridge filter can be provided to remove objectionable odors and foreign matter such as dirt and oil from the incoming air for the further protection of the operator.

Northwestern Plating Company Buys New Belke Multi-Unit Installation

With business definitely on the upgrade the Northwestern Plating Works of Chicago, Ill. have found it necessary to increase their plant facilities by the addition of a new Belke multi-unit plater, made by the Belke Manufacturing Company of 947 N. Cicero Avenue, Chicago, Ill. This new unit is said to have many interesting features that speed up the work and reduce plating costs to a new low. It includes one utility tank, a special three barrel plating tank and two rinsing tanks.



Multi-Unit Plater

New Flexible Cathode Contact Cables Eliminate Old Fashioned Danglers

To insure the highest efficiency of current usage, from hangers to cathode contact cable in the plating tank the oversize bronze conductors are covered with heavy sheet of rubber. It is stated that not only does this assure the greatest efficiency of current usage but that it also gives more plating per ampere, and in this way practically none of the current entering the barrel is lost.

The cathode contact cables, which are on each end of the barrel are constructed of heavy, flexible copper wire, the bodies are thickly insulated and have heavy chromium plated steel knobs on the ends. These press down on the work to provide good contact and uniform current distribution. This exclusive Belke feature eliminates danglers and prevents absorption of the metal in the solution.

Heavy Work of Lifting Barrels Done by Overhead Conveyor

An electric hoist mounted above the unit lifts the plating barrels and carries them back and forth for the different operations. This new innovation eliminates much of the manual labor heretofore associated with electric plating.

Overhead Conveyor Utilized Even to Do Rinsing Job

The work is inserted into the plating barrel while it is resting on the loading or utility stand. The overhead hoist then lifts the plating barrel and places it into the plating tank. After the work has been plated the hoist carries the barrel to the third tank. Here the work rests directly above the first rinsing tray, two doors are opened in the barrel and the work automatically falls into the rinsing tray. The conveyor then carries the plating barrel back to the loading stand where it is ready to be reloaded.

The conveyor is returned to the first rinsing tray which is hinged to the tank on the small end, a hook is attached to the wide end of the tray and the work is given a vigorous slushing in cold, running water. The hoist is then lifted high, and as the tray comes up the work automatically slides through the chute into the second rinsing tray, the hoist hook is attached and the slushing operation is repeated in the last tank which contains hot running water. This gives the work a thorough rinsing. The hoist is then lifted and the work slides out of the tray on each side of an inverted V shaped partition into two baskets at the same time. This last hot water bath also facilitates drying to a great degree.

Tri-Position Portable Grinder

A new heavy duty, tri-position mounted grinder has been added recently to the Mall Tool line of portable grinders.

The tri-position mounting permits the grinder to be used in any three positions; as a bench grinder, suspended from overhead, or as a regular floor machine.

This type of mounting affords unusual portability, and is especially adapted for use in confined places.

Tri-Position Portable Grinder

This grinder can be furnished with either 1½ H.P. or 3 H.P. dust proof motors, and is recommended for heavy duty casting snagging, removing excess metal after welding, polishing stainless steel, and numerous other metal working jobs.

Complete information on this machine and other grinders can be had by writing to the Mall Tool Company, 7740 So. Chicago Ave., Chicago, Ill.

New Rubber-Base Metal Coating Materials

A new line of coating materials has been developed by the Roxalin Flexible Lacquer Company, Elizabeth, N. J. These materials have a rubber base and it is stated fulfill a wide range of commercial specifications.

Roller Coating Material

A new non-silking, drier-less, roller coating material has been developed which, it is claimed, is always clean and free from nibs of oxidized or polymerized particles. Because of its peculiar structure, greater production can be attained through shortened baking time.

This product, which does not skin in the container or in production, is available in all colors, as well as black and white. Without the necessity for using a size coat, it is said to afford excellent adhesion on tin, aluminum, brass and other metals. So great is its flexibility that a wide range of severe forming operations are practicable.

Ground Coat Material for Wood Grain

A new base coat or ground coat mate-

rial has been developed for use under wood grain reproductions. Where this wood grain effect is to be used on metal parts that are to be fabricated from flat sheets, this product is recommended.

It may be roller coated without silking, and without the use of size on sheets of different base metals. It requires a short force-dry or a low-temperature bake after which the wood graining is applied.

There is also a clear top-coat or protecting coat which may be applied in the roller coating machine or for small parts by dipping or spraying. After baking, the system can be buffed in the sheet to a high lustrous wood effect finish with excellent depth, and then blanked and formed into the necessary shapes. Even where the metal has been considerably deformed, the degree of adhesion and toughness is said to be so great that the surface cannot be marred.

Air Conditioning

For air conditioning units where constant cycles of cold, heat, humidity, brine, fumes of refrigerants, alkaline washes, etc., are in constant contact with the finishing materials, many high "corrosive-resistant" systems have been tried.

Rubber-base materials have been recommended repeatedly as a suggested component of a practical anti-corrosive finish.

Now in commercial operation is a system developed by oxalin which, it is stated, has produced films that are impermeable to the above-mentioned destructive corrosive influences. This system is said to yield a most practical result in the form of long-lived, fully flexible finishes which are thoroughly adherent to all metal surfaces without priming coats.

Clear Corrosion-Resistant Finish

Complete resistance to pure alcohol and a number of equally powerful finish-destroying agents has been developed in a new clear finish for machine coating or spray application.

When coated on nitrocellulose base coats, or alkyd synthetic, or oleo-resinous base coats, it tremendously improves the resistance of a finish to alcohol, alkali, acid and water. This new, clear anti-corrosive top-coat bonds very well with the above-mentioned base coats, and may be blanked and formed.

Synthetic With Perspiration Resistance

Rare to the field of synthetics . . . . a new type of synthetic **with perspiration resistance** has been developed which sets-up in air almost as fast as lacquer. It is said to produce a beautiful, high lustre, flexible finish with excellent adhesion to practically all metals, including zinc die castings.

For manufacturers operating automatic spray equipment, this new synthetic is highly recommended for speed-production, requiring only a force-dry of from three to five minutes.

Electrometric pH Meter

Hellige, Inc., 3702 Northern Blvd., Long Island City, N. Y., have developed an electrometric pH meter of general application for the determination of hydrogen ion concentrations with all types of electrode systems. Readings are made directly in pH values.

The instrument consists essentially of a direct-reading pH potentiometer combined with a vacuum-tube circuit for indicating the null point. By means of this vacuum-tube null indicator, the instrument measures glass electrode potentials with the same ease, speed and precision as when using a hydrogen, quinhydrone or antimony electrode, or any other electrode system capable of indicating hydrogen ion concentrations.

All parts of the instrument are built into a strong, polished walnut case, which has a handle. Due to the compact arrangement, the case measures only 9¼ x 7¼ x 8½". As the total weight of the complete instrument is only 13¼ lb. it is not only recommended for use in the laboratory but also carrying on field trips.

The advantages claimed for this instrument are the following:

1. Universal Application. Suitable for use with all electrode systems over their complete range, thus providing for direct readings from 0 to 14 pH.

2. Temperature Compensation. Automatic adjustment for room or bath temperatures between 10°C to 40°C. (50°F. to 104°F.)

3. Applicable as a separate "Null Indicator." When the potentiometer knob is turned to zero, the pH meter can be used similar to our "Vacuum-tube Galvanometer," for a great variety of applications. (See Bulletin No. 7030).

4. Accessible Terminals. Binding posts are provided for easy connection to other systems.

Electrometric pH Meter

5. Removable Electrodes. The electrodes and their holders can be removed and used on a ring stand for titrations or other purposes.

6. Flexibility. Detachable cover and electrode compartment door permits other equipment to be built around the pH meter.

Plate Respirator

A newly improved Dupor Plate Respirator manufactured by H. S. Cover, South Bend, Ind., features a greatly enlarged area in its double filter chambers. The filter pads are 4⅜ inches in diameter and have a clear entrance filter aperture for both pads of more than 24 square inches. Dead air space has been cut to an absolute minimum.

It is called Bulb Valve type No. 24 and has been approved by U. S. Bureau of Mines No. BM 2111, for use in type "A" or Pneumoconiosis Producing Dusts.

Dupor Plate Respirator

The face piece is of standard (patented) Dupor construction with large off-set filter plates attached. The screw cap lid has been eliminated entirely and the filtered air passes easily between the plate extrusions to the protected opening and into the respirator interior. The marginal edge of plate has ingenious, inwardly curved edge to securely anchor filter pads and prevent leakage.

This new construction principle, it is claimed, not only assures a larger filter area for easier breathing but greater comfort to the wearer because of unobstructed vision and extremely light weight. Even the face cloth, which adds so much in comfort to respirator wearers, has also been extended U. S. Bureau of Mines Approval. This means that this additional comfort can be enjoyed with perfect safety.

Without filter pads, this new type construction cuts weight of actual respirator down to 4 ounces.

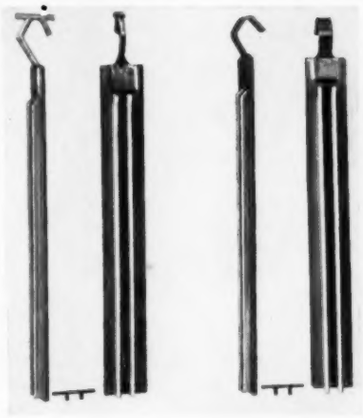
New Chromium Anodes

A new lead anode is now available for chrome platers. It is called "Multi-Edge" and is made by Republic Lead Equipment Co., 7928 Jones Road, Cleveland, Ohio.

Its multiple edges (8 corners) give, it is claimed, greater throwing power and greater plating efficiency than the conventional flat or curved anodes. Built like a structural beam, these reinforcing ribs reduce any tendency to curl.

Multi-Edge is made by the extrusion process, with firm and dense texture to the lead. The hooks are burned in by the homogeneous lead burning process, assuring 100 per cent electrical contact between hook and anode; furnished with knife edge hooks 3 inches or 4½ inches long, or flat cold-rolled copper hooks 2 to 6 inches long formed to the user's specifications.

Every anode is stenciled showing the correct height for the solution level.



Multi-Edge Lead Anode. Left—¼′ x 3″ anode with knife edge copper hook. Right—¼″ x 3″ anode with flat cold-rolled copper hook

Anode Saver

The "Anode-Saver" is a basket—constructed of expanded metal, heavily rubber insulated. The average dimensions are 5″ x 9″ x the usual depth of tank. It is equipped with heavy insulated metal hooks for hanging on the bus bar.

A good anode hangs in the center, around which the basket is filled with scrap material.

In many plating departments, the loss from anode scrap runs into a pretty figure. This loss, it is claimed, can be converted into a profit by the use of an Anode-Saver. One firm fills the Anode-Saver with as much as 200 pounds of scrap and they report very satisfactory results. One Anode-Saver 9″ wide will occupy the space of three good anodes. This gives a direct saving of two anodes replaced by the scrap material.

Collord Anode-Savers are made to order by Collord, Inc., 7049 Lyndon Avenue, Detroit, Mich.

Addition Agent for Chromium Plating Solutions

Standard Chromium Corp., 521 Fifth Ave., New York, have developed a concentrated addition agent for the consumption of sulphate chromium plating solutions, by which it is stated, the throwing power is greatly increased and sulphate concentration is automatically maintained in the most effective zone without chemical analysis or the addition of sulphates.

This addition agent is supplied as two separate concentrated solutions. To make the initial conversion of the ordinary sulphate bath requires the addition of the Preparatory Solution (No. 1) plus the Operating Solution (No. 2). Thereafter only the Operating Solution need be added regularly—at the same time that chromic acid is normally added to the bath.

Before the change is first made, the bath should be adjusted to approximately 20 deg. Be. Then add two gallons each of Solutions No. 1 and No. 2 for each 100 gallons in the bath. The bath is then thoroughly stirred and allowed to stand overnight. In the morning it is ready for operation.

When further additions of chromic acid are made, they should be accompanied by one fluid ounce of Solution No. 2 for each pound of chromic acid added. Occasionally, at intervals of six months to a year, a small amount of Solution No. 1 can be added as a precautionary measure.

New Enamel Produces Chemical Metal Colorings

The colors produced on metals by the anodic process and other chemical coloring methods can now be economically produced by a new line of enamels developed by Maas and Waldstein Company, Newark, N. J., according to a statement by that company.

This new type of enamel, known as "Platelustre," is semi-transparent and, when mixed with clear lacquers gives a clear, brilliant, transparent colored effect that is said to be fast to light and very durable. Platelustre is supplied in a large assortment of colors, permitting the reproduction of all popular chemical metal coloring effects as well as making possible new effects, without the use of chemical processes.

Metals of all kinds can be finished with Platelustre. It is especially suitable for compacts, lighting fixtures, novelties, casket hardware, and other products where a brilliant colored metallic finish is desired.

New Truck Casters

A new type of swivel and rigid truck caster called "LoWate" has been designed by Divine Brothers Co., Utica, N. Y. They are said to be an unusually sturdy, medium duty truck caster, of simple and inexpensive design with single ball race of ample proportion to function under load. The top plate and fork are smooth machine castings. Ball bearings are of grade A chrome nickel steel. The casters are permanently rustproofed by the Parkerizing process, and with a dull black oil finish.

"LoWate" Truck Caster

Wheels may be of metal, canvas cushion molded DuRock or DuFlex.

Plating Rack Coating

Zetyl is the trade name of a synthetic gum or resin in liquid form for insulating plating racks. It is used cold just as it comes from the can and can be applied with a brush, spray gun or by dipping. Zetyl is recommended for use in all plating operations and is said to be particularly effective in chrome plating; will withstand the action of all acids and alkalies with the exception of hot concentrated nitric acid. Can be applied directly to the rack, or the rack can be wound with a thin cotton tape and the coating material applied over the tape. Gives a dull black coating but does not contain pitch or any added pigment.

Zetyl is also being used as a protective coating on laboratory tables and equipment. It is recommended for wood surfaces as well as metals.

Zetyl is made by Nelson J. Quinn Company, 417 13th Street, Toledo, Ohio.

Circular Knife Grinder

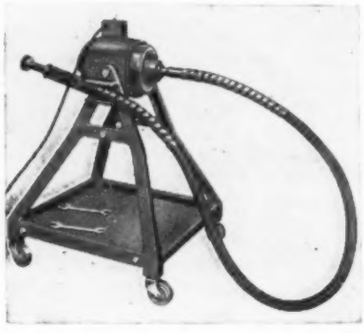
Grinder for Circular Knives

A grinder for circular knives, built down to a price which makes it feasible for the user to sharpen his own circular knives in his own plant is now built by Samuel C. Rogers and Company, 191-205 Dutton Ave., Buffalo, N. Y. It is claimed that the grinder is so simple to operate that any handy man can turn out a perfect grinding job on either single or double bevel knives from 2" to 20" diameter.

It is stated that this machine will eliminate the trouble and expense of sending knives outside for sharpening; also that it will increase the capacity of the cutters and assure perfectly sharpened knives at almost a moment's notice.

Portable, Flexible Shaft Grinder

A newly designed "Multi-Service" portable, electric, flexible shaft grinding machine is being manufactured by Swartz and White Mfg. Co., 243 Water St., Binghamton, N. Y., called their Bingo G-1 machine. The machine is intended to do almost any job around the shop: grinding, sanding, drilling, burnishing, polishing, reaming, buffing, etc., on flat or irregular surfaces. It is driven by a ½ horsepower motor, available for a 110-220 volt service, single phase, 60 cycle. The motor is a ball bearing unit supplied on their assembled stand which includes two side frames, tool tray and four casters. The flexible shaft is furnished complete with ball bearing handpiece, wheel arbor and two wrenches.



Portable Flexible Shaft Grinding Machine

Alloy for Sealing-to-Glass

"Kovar" is the trade name of an alloy, having a low coefficient of expansion developed for making vacuum tight seals with glass, and is now being distributed by The Stupakoff Laboratories, Inc., 6627 Hamilton Ave., Pittsburgh, Pa.

The outstanding qualities claimed for "Kovar" are as follows:

1. Readily seals into hard glass (high resistance to thermal shock).
2. Produces a permanently vacuum tight seal, due to matching expansivity and bonding characteristics.
3. Resists mercury attack.
4. Easily machined and otherwise cold formed permitting use on intricate shapes.
5. Can be soldered, brazed or welded to other metals.
6. Relatively inexpensive, eliminating restraints on size and capacity of sealed-off gas conduction devices.
7. Uniform composition, permitting duplication of results.
8. Eliminates the need of a "feather edge" on tubular shapes.

Typical applications of "Kovar" are in the following devices:

Radio and other Electronic Tubes.

Mercury Switches.

Electro-medical Apparatus.

Electrical and Thermometric Instruments.

Sealed-in units for Refrigerators.

A bulletin recently issued by the Stupakoff Laboratories, Inc., contains technical data including properties, sealing technique, typical uses and list of available standard shapes.

Electric Temperature Controls

Sarco Company, Inc., 183 Madison Ave., New York, manufacturers of steam specialties, announce the completion of a new line of electric temperature controls for heating, air conditioning, refrigeration, and industrial processes.

These developments are based on patents and designs Sarco has acquired from Wilbin Instrument Corp., which company has been liquidated.

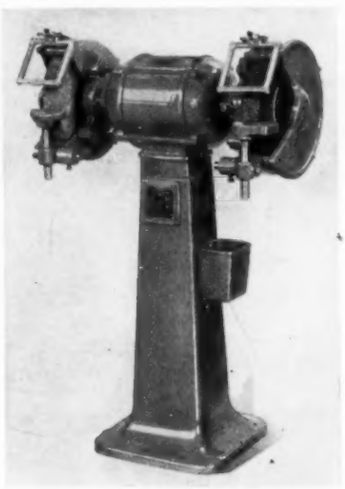
The new line includes line voltage thermostats, ranging from simple room types to multiple switch dial thermometer thermostats for the most exacting industrial requirements. Included also are hydraulically operated motor valves for steam, gas, oil, water, brine, or freon.

A thermostat and one of the motor valves are shown herewith. A complete catalog is now ready for distribution.

Clark 2 H. P. Grinder

The 2 H.P. grinder illustrated is the latest addition to the line of grinders, made by the Jas. Clark, Jr. Electric Co., 600 E. Bergman St., Louisville, Ky. It comes equipped with push button control with overload protection, enclosed safety guards, adjustable for wheel wear, and non-shatterable glass eye shields, tool rest, adjustable both horizontally and vertically, water pot, two 12x2" face and 1" hole grinding wheels. Optional feature on this grinder is exhaust opening in bottom of wheel guards.

The motor is totally enclosed; the rotor shaft is mounted in heavy duty precision type ball bearings, grease lubricated and sealed against grit and dirt. The motor is rated 2 H.P. for continuous duty at 1,750 R.P.M. with a 55 degree Centigrade rise. The motor, manufactured by the company, will stand a momentary overload of 100%. The motor frame is of small diameter, permitting maximum wheel wear and maximum clearance for work. All unnecessary and awkward brackets have been removed, giving machine a very trim and compact appearance.



Clark 2 HP. Grinder

The total weight of the grinder is net 445 pounds; shipping weight 535 pounds. Machine is especially recommended for production work or general tool grinding in all types of manufacturing plants, machine shops and foundries.

"Hylow Permaglo"

Grand Rapids Varnish Corporation "HyLow Permaglo" has been so named, it is stated, because it is the first successful combination of the now recognized outstanding qualities of the high baking glyptal synthetic enamels with the low baking temperatures available to the average manufacturer of metal products. The outstanding resistance of the high baking glyptal synthetics to shock, moisture, greases, acids, etc., which resulted in wide adoption of this type of finish by electric and ice refrigerator manufacturers, has heretofore been unavailable to all but the few who could make the necessary expensive oven and air conditioning installations. Heretofore paint chemists have been unable to produce these qualities and characteristics, particularly in white, except in the high temperatures and long bakes.

In this product the chemists of the Grand Rapids Varnish Corporation Laboratories, Grand Rapids, Mich., offer in whites and all colors a finish which, it is claimed, in all respects and attributes compares with the high temperature, long baking, glyptal synthetics, but which bakes at temperatures of from 200° to 250° F. A particular feature claimed for this material is that it possesses a harder surface immediately upon emerging from the oven than do the higher baking synthetics, thus reducing and eliminating mars resulting from handling.

Finishes of two or three coats are available to manufacturers whose product requires those qualities generally associated with high baking synthetics. Cost of this finish, it is claimed, is surprisingly low.

New Primer

Rusticide Products Co., Cleveland, Ohio, has announced a new product for preparing metal before the paint finish is applied. The product known as Rusticide "50", is said to clean and etch the metal leaving a rust-proofed surface conditioned for painting.

Based primarily on the original Rusticide formula, the new product, it is claimed, immediately dissolves from the metal all foreign materials such as grease, oil, wax and surface oxidation. Deeply pitted rust can be removed instantly in presence of Rusticide "50" with the aid of steel wool, eliminating the necessity of sanding.

Shipped in concentrated form, the material is diluted with 2 to 3 parts water. It may be applied with cloth, brush or spray gun and is removed either by wiping with dry cloths or dipping in water. The metal is ready to paint 10 minutes after treatment and is protected from fresh oxidation for a period of several days.

Rusticide "50" is non-inflammable, non-explosive and non-toxic. Its quick action and prompt drying makes it entirely suitable for high-speed production work when "time-out" is costly and impractical.

New Cleaners

E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa. announce an entirely new series of metal cleaners to be known as the Houghto-Clean, 100 Series. They replace the earlier series of the same name and cover a wider range of operations.

The 100 Series is made up of nine (9) compounds covering light, medium and heavy duty cleaning. They will, it is stated, do an efficient and rapid cleaning job in any operation where an alkaline cleaner is desired, and will remove all kinds of oils and greases—animal, vegetable and mineral. One grade is specially designed for cleaning after carburizing.

This Houghto-Clean Series is said to be adaptable to tank, high pressure washing, steam gun, electrolytic and many other cleaning operations, and leave the metal surfaces in the proper condition for japanning, galvanizing, electroplating, lacquering or any other type finishing. Each is a balanced cleaner, free rinsing and exceptionally efficient at low temperatures.

A folder has been prepared which describes the individual members of the Series and gives their properties and uses. This folder can be had by writing to E. F. Houghton & Co. at the address given above.

Associations and Societies

Baltimore-Washington Branch A. E. S.

Care of Arthur G. Pierdon, 5331-42nd St., N. W., Washington, D. C.

The Baltimore-Washington Branch of the American Electro-Platers' Society will hold its annual meeting and banquet February 13th, 1937, at the Rennert Hotel, Baltimore.

All platers and others interested in electroplating are cordially invited.

Electrodepositors' Technical Society

Northampton Polytechnic Institute, St. John St., London, E. C. 1, England

The provisional program for the International Conference on Electrodeposition, to be held in London, March 3rd and 4th was published in our December 1936 issue, p. 497. Below is a list of papers to be presented by American authors.

1. **The Crystal Structure of Copper Electrodeposits.** Arthur Phillips, Prof. Metallurgy, Yale University. Walter R. Meyer, Electrochemist, General Electric Co., Bridgeport, Conn.
2. **Developments in the Electrodeposition of Platinum Metals.** K. Schumpelt, PhD., Chief Electrochemist, Baker and Co., Inc., Newark, N. J.
3. **The Cyanide-Cadmium Plating Solutions. Dr. Gustaf Soderberg,** Chief Chemist, Udylite Co., Detroit, Mich.
4. **Methods of Determining Thickness of Electrogalvanized Coatings.** Dr. A. K. Graham, Assistant Prof., Electrochemistry, Univ. of Penn., Philadelphia, Pa.
5. **Studies Evalulating the Brightness of Electrodeposits.** Dr. B. Egeberg, Chief Metallurgist, International Silver Co. N. Promisel, Electrochemist, International Silver Co., Meriden, Ct.
6. **A Resume of Silver Plating.** Frank C. Mesle, Research Engineer, Oneida Ltd., Oneida, N. Y.
7. **Electroplating — American Practice.** George B. Hogaboom, Engineer, Hanson-Van Winkle-Munning Co., Matawan, N. J.

Personals

D. J. Gregory has been appointed chief engineer of the Hydraulic Press Division of the Farquhar Co. Ltd., York, Pa.

F. R. Hoadley was presented with a silver plaque by the employees of the foundry and pattern departments of the Farrel-Birmingham Co., Inc., Ansonia, Conn., as a testimonial of the respect and esteem; with regret for the severance of the friendly associations of 22 years. Mr. Hoadley has resigned as vice-president of the Farrel-Birmingham Co., to become president of the Atwood Machine Co., Stonington, Conn.

George B. Hogaboom was operated on for appendicitis at the New Britain General Hospital, New Britain, Conn. on January 3rd. We are glad to report that he is doing well. By the time this issue reaches its readers Mr. Hogaboom will be back at home, 557 Stanley St., New Britain, Conn.

Ernest T. Fisher, well known to the industry through his more recent connection with the **Illinois Foundry Company,** Springfield, Illinois in the capacity of Superintendent and Assistant Manager, has recently become associated with the **Claude B. Schneible Company,** 35 E. Wacker Drive, Chicago, Ill., manufacturers of dust suppressing equipment. He will act in the capacity of sales engineer, covering the territory contiguous to St. Louis.

Joseph B. Kushner has taken a post with the firm of A. Robinson & Son, 131 Canal St., New York, in charge of the precious metal plating department.

Royal F. Clark Sr., who for past seven and a half years was foreman plater at **C. T. Williamson Wire Novelty Co.,** Newark, N. J., is now in charge of the plating department of the **Artistic Metal Novelty Casting Co.,** 460 W. 34th St., New York.

Necrology

Among the men of prominence in the metal industries who passed away during 1936 were the following:

Daniel Kelly, retired Superintendent of American Brass Co., Torrington, Conn.

Albert F. Shore, inventor and metallurgical engineer, and President of Shore Instrument & Mfg. Co., Jamaica, L. I.

John W. Pilling, founder, president and treasurer, Pilling Brass Co., Waterbury, Conn.

Clive B. Vincent, Chairman of Board of Directors, Torrington Co., Torrington, Conn.

Joseph W. Marsh, Vice-Chairman of the Board, General Cable Corp., Pittsburgh, Pa.

Frederick S. Magnus, Vice-President and Treasurer, Maas & Waldstein Co., Inc., Newark, N. J.

Maurice Weill, retired, founder, Illinois Smelting & Refining Co., Chicago, Ill.; also founder, Sandoval Zinc Co., Sandoval, Ill.

Theodore Clyde Foster, President and Treasurer, Theodore W. Foster & Bro. Co., Providence, R. I.

Samuel Schwartz, President, Schwartz Mfg. Co., Two Rivers, Wis.

Alfred K. Potter, Acting President and Director, Jewelers Board of Trade, Turks Head Bldg., Providence, R. I.

Alexander H. Boyd, New York Manager, Hanson-Van Winkle-Munning Co., Matawan, N. J.

E. H. Frohman, Vice-President, S. Obermayer Co., Pittsburgh, Pa.

Purcel O. Seiser, Superintendent, U. S. Aluminum Co., Fairfield, Conn.

Joseph D. Sargent, Sargent & Co., New Haven, Conn.

Leonard Bishton-Botfield, President, Botfield Refractories Co., Philadelphia Pa.

Franklin Holcomb Loomis, Sales Manager, Copper Sheet & Roofing Division, American Brass Co., Waterbury, Conn.

Dr. Lucius Pitkin, Consulting Chemist and Metallurgist, Lucius Pitkin, Inc., 47 Fulton St., N. Y.

Ferdinand W. Roebling, Jr., President, John A. Roebling's Sons Co., Trenton, N. J.

George H. Feltes, President and Treasurer, Standard Electrical Tool Co., Cincinnati, Ohio.

Abel Kenworthy, organizer and builder, Waterbury Rolling Mills, Waterbury, Conn.

Frank Ennis, Production Manager, Baird Machine Co., Bridgeport, Conn.

W. J. O'Neill, Vice-President, B. Mercil & Sons Co., 1911 Fulton St., Chicago, Ill.

James E. Nagle, President, James E. Nagle & Sons, 3835 Seiss Ave., Toledo, Ohio.

F. S. Chamberlain, director, Stanley Works, Bristol Brass Co., North & Judd, and Skinner Chuck Co.

Mary Hegeler Carus, President, Matthiessen & Hegeler Zinc Co., and Bronze Metal Products Co., La Salle, Ill.

Robert J. Leighton, Secretary and Treasurer, William J. Gilbert Clock Corp., Waterbury, Conn.

Edward Weston, inventor, 37 N. Mountain Ave., Montclair, N. J.

William H. Nicholls, President, William H. Nicholls Co., Inc., Richmond Hill, L. I.

Carl F. Isselman, Vice-President, Aluminum Goods Mfg. Co., Manitowac, Wisc.

William A. Jack, Vice-President, Grand Rapids Brass Co., Grand Rapids, Mich.

William H. Lewis, former Superintendent and General Manager, National Conduit & Cable Co., Hastings-on-Hudson, N. Y.

Sherard Osborn Cowper-Coles, inventor, sherardizing process of zinc-coating iron, Sunbury-on-Thames, England.

John Campbell, President, Campbell Fdy. Co., Harrison, N. J.

William S. Rowland, President, Stanley Chemical Co., E. Berlin, Conn.

John Frelinghuysen Harman, member of Board of Directors, Handy & Harman, 82 Fulton St., N. Y.

Harry Flint Huff, Manager, extruded metals and die press department, American Brass Co., Kenosha, Wisc.

Frank L. Goetz, Second Vice-President, James H. Rhodes & Co., Long Island City, N. Y.

Dr. William Campbell, Professor of Metallurgy, Columbia University, New York.

Charles Bodman, President, Magnus Metal Company, Denver, Colo.

Bartholt H. Hubbert, President, B. H. Hubbert & Son, Baltimore, Md.

Business Items-Verified

The following new appointments are announced by Maas and Waldstein Company, makers of lacquers and enamels, 438 Riverside Ave., Newark, New Jersey: **Export Manager, Henry R. Jahn,** 7 Water Street, New York; **New England Representative, W. C. Treadwell,** 22 Vine Street, Melrose, Massachusetts; **New York-Pennsylvania Representative, John Dahlquist,** 411 Forest Avenue, Jamestown, New York.

Special Chemicals Corp., 30 Irving Pl., New York, announce the addition to their sales staff of R. C. Peck, formerly with the Seymour Products Co., and S. R. Bonwit, formerly with the Enequist Chemical Co.

The **Hilo Varnish Corporation,** 42-60 Stewart Ave., Brooklyn, N. Y., have added to their staff as consultant, Dr. C. B. F. Young, Electrochemist. Dr. Young is an instructor, both at Columbia and at New York University, and he is well known to readers of **Metal Industry.**

Frederick Gumm Chemical Co., Inc. announce their removal to 538-542 Forest St., Kearny, N. J. Former address, Union City, N. J.

Thomas H. Wilbur has recently been appointed General Manager of the Bullard-Dunn Process Division of The Bullard Company, Bridgeport, Connecticut. This Division engineers and licenses the use of the Bullard-Dunn Electro-Chemical Process for the descaling of metals. **Thomas E. Dunn, Jr.** has also been appointed to the Sales Department of the Bullard-Dunn Process Division, and will have his offices at 309 Miller-Storm Building, 12015 Linwood Avenue, Detroit, Michigan.

On December 8, 1936, following the annual meeting of the stockholders, the Board of Directors of Maas and Waldstein Company, makers of lacquers and lacquer enamels, 438 Riverside Ave., Newark, N. J., reelected the following officers: **President, M. A. Maas;** Vice-

President and General Manager, G. Klinkenstein; Treasurer, R. F. Magnus; Assistant Treasurer, C. L. Anderson; Secretary, G. Klinkenstein.

Mr. Maas's reelection to presidency marks the twelfth successive year in which he has held this office. Mr. Klinkenstein was elected general manager of the company last year. He has been associated with Maas and Waldstein for over 20 years, having held the positions of chemist, chief chemist, and director of research before being placed in charge of the company's management. Mr. Magnus succeeded his father, the late Frederick S. Magnus, who was treasurer of the company from 1914 until his death early in 1936 and was an outstanding figure in the lacquer industry. R. F. Magnus has been connected with Maas and Waldstein for ten years.

Industrial News

Courses in Electroplating at Columbia University

For those desiring information on courses given in the evening on electroplating the following information is offered:

Registration begins Saturday, January 30 and the first class will be held, Wednesday evening, February 3. Two courses will be offered for those who are interested in this field. The first course Chemical Engineering E-84 in practical electroplating, is designed to give the practical electroplater advanced study of ways and means of obtaining better deposits by applying the latest scientific methods of electrochemistry to electroplating. One our of each evening is devoted to the theoretical aspects of electroplating and the remaining two hours are devoted to the application of these principles by the student in the laboratory. Copper, nickel, zinc, cadmium, chromium, silver, and brass will be deposited from aqueous solutions. While plating the above metals, the factors governing the character of the deposit will be noted by the student. In the latter part of the semester the student will analyze the constituents of each solution.

Chemical Engineering E-85, Investigation of Special Problems in Electrochemistry, is a course designed to give the practical electroplater a chance to investigate problems which are related to his field of work. One half hour of each evening is devoted to a conference with the instructor. The remaining two and one half hours are spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Both courses are open to students on approval of the instructor.

Further information can be obtained by calling Dr. Young at HAvemeyer 4-7625.

Chromium Patent Decision Upheld

On October 26 United Chromium, Inc., 51 East 42nd St., New York, filed a petition for a re-hearing and re-argument of the case of United Chromium, Inc., vs. General Motors, et al, in which the U. S. Circuit Court of Appeals for the second circuit had reversed the decision of Judge Thomas of the Federal District Court in Hartford, Conn. Judge Thomas had ruled in favor of United Chromium; the Circuit Court of Appeals had ruled in favor of General Motors.

The Circuit Court granted the petition for re-argument, which was held during December and then affirmed its previous decision, reversing the decree of Judge Thomas.

Waterbury Firms Raise Wages

Scovill Mfg. Co., American Brass Co., and Chase Brass & Copper Co., all of Waterbury, Conn., have announced a wage increase of 5% for hourly and piece-rate workers. Waterbury Buckle Co. and Waterbury Farrel Foundry and Machine Co. have announced bonuses ranging from 2% to 5%.

Metals at the Power Show

The annual National Power Show was held as usual, in New York, in connection with the annual convention of the American Society of Mechanical Engineers. The show was held at Grand Central Palace from November 30th to December 5th inclusive. The brass and copper industry was very well represented. Among the exhibits were the displays of the American Brass Co., Waterbury, Conn., Scovill Mfg. Co., Waterbury, Conn., Chase Brass & Copper Co., Waterbury, Conn., Bridgeport Brass Co., Bridgeport Conn., and Revere Copper & Brass, Inc., 230 Park Ave., New York. A wide variety of copper base alloy products was shown including tubing of all sorts, forgings, specially fabricated material, etc. Nickel was displayed in a wide variety of forms and uses by the International Nickel Co., 67 Wall St., New York.

Exhibits of accessories and supplies included refractories and abrasives of the Carborundum Co., Niagara Falls, N. Y.

Seal of Approval for Lead Products

To assist purchasers and specifiers in obtaining only the highest quality lead pipe, traps and bends, the Lead Industries Association, 420 Lexington Ave., New York, has adopted rigid standards covering the manufacture of these products. In addition, it is licensing manufacturers to use a "Seal of Approval" to be stamped on pipe, traps and bends complying with the Association standards.

Naturally, the co-operation of architects, engineers, plumbers, plumbing inspectors, supply houses and others who buy, sell or specify lead products, will be necessary to make the standards and "Seal of Approval" most effective.

Stevens Sales Convention

Frederic B. Stevens, Inc., Larned & Third Sts., Detroit, Mich., held their first annual sales convention, December 29th and 30th, at the Hotel Statler, Detroit. The program of this convention included addresses by W. J. Cluff, J. M. Mayers and G. H. Quinn of the Stevens company. Papers were read by L. R. Eastman on Buffing Composition; J. A. Ridderhof on Facing Mill Products; A. H. Hannon on Plating Machinery, and J. M. Mayers on Lathes.

The gathering was addressed at a luncheon by R. H. Grant, vice-president, and at a banquet by Justice George E Bushnell and ex-Congressman J. F. Hughes.

Among the features was an inspection trip through the Ford Motor Company foundry and plating departments and a visit to the Ford Rotunda.

Talks were given by suppliers of the Stevens company, among which were the following: Pennsylvania Salt Co., Philadelphia, Pa.; Wood Shovel & Tool Co., Piqua, Ohio; North American Refractories Co., Cleveland, Ohio; Detroit Rex Products Co., Detroit, Mich.; Electric Products Corp., Cleveland O.; McGean Chemical Co., Cleveland; Acme Mfg. Co., Detroit, Mich.

Holiday Greetings and Calendars

We acknowledge with thanks the receipt of holiday greetings, cards and calendars from thhe following:

Agate Lacquer Mfg. Co., 11-13-43rd Rd., L. I. City, N. Y.
Aluminum Co. of America, Pittsburgh, Pa.
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frederick Gumm Chemical Co., 538 Forrest Ave., Kearny, N. J.
Joseph Haas, 330 E. 209th St., New York City.
Mr. & Mrs. George B. Hogaboom, Matawan, N. J.
Lea Mfg. Co., Waterbury Conn.
William E. Paulson, Thos. Paulson & Son, 415 Union St., Brooklyn, N. Y.
Philadelphia Quartz Co., 121 S. 3rd St., Philadelphia, Pa.
Charles H. Proctor, 309 Vine Ave., Clearwater, Fla.
Sulphur Products Co., Greensburg, Pa.
Sam Tour, 47 Fulton St., New York.
O. S. Tyson & Co., 230 Park Ave., New York City.
United Engineering & Foundry Co., Pittsburgh, Pa.
Mr. and Mrs. R. F. Wood, 810-18th St. N. W., Washington, D. C.
Chas. Yerger, Hanson-Van Winkle-Munning Co., Matawan, N. J.

The Markets for Metals

BY A GROUP OF OUTSTANDING EXPERTS

A Summary of the Commercial Situation in the Most Important Primary Metals.

COPPER

By WM. G. SCHNEIDER

New York

THE copper industry during the past year staged an overdue revival.

At the close of 1935 the price of copper was about 9c with an average price for 1935 of 8.65c. At the close of 1936 the price was 11.625c to 12c a pound. Foreign demand for copper was a deciding factor in determining prices.

At the end of 1935 total stocks of copper amounted to about 500,000 tons. During 1936 these stocks were reduced about 175,000 tons to approximately 325,000 tons. Total stocks of copper in the United States decreased about 60,000 tons to a total of approximately 170,000 tons during 1936. Refined stocks in North and South America were reduced during 1936 by about 75,000 tons to about 85,000 tons.

Total consumption in 1936 is estimated at about 1,850,000 tons. The large amount of copper consumed and needed abroad is apparent in view of an estimated domestic consumption of 750,000 tons. This domestic consumption is the largest since the year 1930 when about 950,000 tons were used.

WILLIAM G. SCHNEIDER

Production in 1936 was about 10% greater than in 1935 and amounted to about 1,635,000 tons.

The outlook for copper is very promising. The public utilities, one of the major markets for copper, are far behind in their needs and have virtually reached their productive capacities for power. In the near future, other factors remaining normal, they should be in the market for a great deal of copper and equipment. War possibilities create urgent demands for copper. The building industry, another important outlet for copper, gives indications that it may get underway on a reasonable scale during 1937. The automobile, refrigerator and other industries have staged a comeback. All in all it looks as if plenty of copper will be needed. The outlook and actual situation is one to inspire confidence.

TIN

By C. L. MANTELL

Consulting Engineer, New York.

ACCORDING to TIN, the official monthly bulletin of the Tin Producers' Association, for the first ten months of 1936 the total supplies of tin from the Straits was 70,826 tons as compared to 46,281 tons for the corresponding period last year. Stocks at the end of October 1936, not including tin afloat, were approximately 17,000 tons as compared to 10,000 tons last year.

Consumption in the United Kingdom for the first ten months of 1936 was of the order of 20,000 tons as compared to 15,000 tons for the same period last year. United States deliveries of tin for the first ten months were 61,730 tons as compared to 49,715 tons last year. Tin delivered to countries other than the United Kingdom and the United States over the same period amounted to 22,251 tons in 1936 as compared to 20,957 for 1935. On this basis, world consumption of tin for the first ten months of 1936 was of the order of 104,000 tons as compared to a little less than 86,000 tons for the same period last year. An estimate of the world's tin consumption for 1936 would place it from 125,000 to 130,000 tons.

New York prices for Straits tin ranged, according to the Engineering & Mining Journal, from an average of 47.23 cents in January to 48.04 cents in March, dropping as low as 42.20 in June and then rising slowly but steadily to 44.98 in October, 51.4 in November, and of the order of 52.5 in December. At the end of the year, the American Metal Market quoted 52.5 cents for Straits, the same price for English or Dutch refined, 52.35 cents for American refined 99.90%, and 52.00 for 99% optional brands.

The influence of beer on the tin can consumption has continued and been extended. It is of interest to note that one ton of tin means approximately a million tin cans. How close America has come to the "tin can consumed per person per day" is not yet definitely known.

Tin plating of cast iron automobile pistons was given a temporary set-back by the adoption of aluminum pistons which are now either anodically treated or in turn tin plated. Job shop tin plating of automotive pistons has grown quite markedly.

Collapsible tubes of tin, whose departure from the market was predicted by proponents of aluminum some years ago, have continued to hold their own

as well as find new fields as containers.

Despite the development and use of cadmium-silver bearings, copper-lead, and other competitive materials of babbitt, the consumption of tin in the solders, bearing metals, and white metals increased appreciably during the year, concurrent with increased industrial production. The outlook for 1937 is good.

ZINC

By W. R. INGALLS

Director, American Bureau of Metal Statistics, New York.

THE situation in zinc in 1936 was of no great interest until near the end of the year. Consumption in the United States increased substantially, conforming to the up-grade in the general economic trend. There was improved consumption in galvanizing and for rolling, more so in brass making and even more in die casting, but as an offset there may have been some impairment in oxide. Anyway, production was well restrained, perhaps through inability to increase it very much at the prevailing level of price, and the stock of spelter in first hands was reduced to relatively small proportions, perhaps to a quantity that ought to be on hand for safety. During most of the year the zinc market showed signs of wanting to go up, but was restrained by the existence of a low import ceiling.

The foreign position was not so good, with the price for spelter falling to

W. R. INGALLS

£13.5 in August. Several conferences among producers occurred in London to consider a revival of the old cartel, but it proved impossible to arrange any composition, the interests among producers being so diverse, both organically and nationally. There was of course always the shadow of increasing zinc production in countries like Germany, which possess zinc ore and are ambitious to provide their own supply of spelter. Madgeburg having come into full operation, the first unit of the new plant at Oker is expected to begin production about the end of 1936.

Although outside of the United States there was a slowly increasing consumption there were also an increasing production, checked temporarily by a strike in Belgium during the summer and later by interference with the Spanish production, which is, however, but small. It is, of course to be observed that the larger part of the zinc and lead production outside of the United States is derived from ores that yield both metals and the brilliancy in the position of lead has rather dazzled zinc. It has been many years since we have seen such a wide spread between the London prices for lead and zinc as has recently existed.

In November the London price for zinc advanced and it has gone substantially higher in December. An explanation of this may be a participation in the general bull market that has been enjoyed in London, and the prospect of an armament program in which zinc would be required as well as copper. With this lift of the import ceiling an advance in our domestic price became possible and developed quite sharply without any resistance from consumers.

LEAD

By F. E. WORMSER

Lead Industries Association, New York

THE year 1936 was the best for lead since 1930, as shown by the course of the price of New York lead which advanced from 4.50c per lb., at the beginning of the year to 6.00c at the end, with the advances occurring mainly in the last half of the year. This marked improvement was caused both by a large increase in the amount of lead consumed by domestic fabricators during the last quarter of 1936, and to the extraordinary strength of the London market. At times the London market was slightly higher than New York, an unusual and temporary relationship.

In the face of the best demand that lead has experienced for years, producers had to draw heavily upon their stocks. In the last quarter of 1936 about 60,000 tons of lead per month were being shipped by refiners, whereas only about 37,000 tons were being produced by the mining companies, which, supplemented by recoveries of scrap lead, was still insufficient to supply the demand. Consequently, the statistical position of lead which has long been unsatisfactory owing to the large accumulations, has returned to a much better position. Pig lead stocks are now equivalent to less than three months' supply. A shortage of prompt lead in Europe, caused largely by the absence of the customary supply from Spain, plus a growing demand for lead for munitions purposes abroad, is believed to have been responsible for the activity in London lead. In the United States a shortage was caused not only by a labor strike in Utah in the lead mines, but also by a larger demand for lead for white lead, red lead and litharge, and in foil, battery manufacture, cable sheathing, plumbing and other lines. In fact, the improvement was noticeable in practically every market available to lead. Some of these outlets are expected to show further growth in 1937. This is especially true of the demand for lead in sheathing cable, as the utility industry is making extensive plans to meet a great increase in the use of its product and will require some new distribution networks.

It is also reasonable to anticipate an increased production of lead, prompted by the 6.00c market. A few properties shut down during the depression are likely to be reopened. Mine production in the United States has been at the rate of about 37,000 tons per month during 1936 and it can stand a higher rate unless there should be a falling off of lead requirements by consumers.

The non-ferrous metals are among the last commodities to recover from the depression. Most of them, and especially lead, have a highly diversified market which will require more metal as recovery progresses.

The higher price of lead in 1936 has not brought out a larger quantity of scrap lead and the influence of this material has grown smaller as the volume of mine production has increased. Although nearly all uses of lead, except white lead and ammunition manufacture, are sources of scrap lead, recoveries of scrap lead are generally more dependent upon such factors as depreciation and obsolescence than they are upon the market price of lead.

On the whole, the future for all branches of the lead industry looks brighter for 1937 than it has for at least six years.

THE PLATINUM GROUP

By CHARLES ENGELHARD

President of Baker & Co., Inc., Newark, N. J.

WORLD purchases of platinum metals including palladium in 1936 will probably exceed 400,000 ounces, judging from indications received just before the year's end. This establishes a new record in the use of these metals and a remarkable gain over the 1935 figure of 275,000 ounces.

World production, outside of Russia, has increased, primarily because, with nickel mines and refineries operating at an unprecedented rate, the amount of platinum recovered from Canadian nickel ores has been correspondingly larger. The situation in Russia is not definitely known, except that Russia apparently withdrew from world markets during the summer. Presumably, however, production in Russia has not fallen off. Production in South America and South Africa has been normal, as has also the world secondary production.

In general, the improvement in the demand for the platinum metals is a continuation of the trend which began about half way through the year 1935. Superimposed upon this, however, was a spectacular rise in price, which received its real impetus from an unanticipated improvement in world demand coupled with speculative and investment buying. During the six-month period from April to September, the price of platinum went from $33 an ounce to $70, and subsided toward the year-end to the more normal figure of $48.

In this period purchases of platinum alone were at a rate in excess of 300,000 ounces a year, and it was not unnatural for the trade to be concerned about supplies in the face of such an abnormal demand.

The jewelry industry continued to be a most important user of these metals. The amount of platinum going into jewelry continued to reflect the accelerating rate of industrial and business recovery as well as the recovery in the marriage rate.

Platinum and palladium have been standard materials for dental work for many years, and their position was further strengthened this year as a result of investigations which covered the range of metals used by dentists. These studies indicate that no other materials compare favorably with the precious metal alloys of platinum-gold-palladium for dental structures.

Platinum-clad material progressed from the discussion stage to one of usefulness in industry. Platinum-clad material is practical for reaction vessels formerly considered too large to be made of this precious metal.

In addition, there have been increases in the use of platinum and palladium for electrical contacts and of platinum and rhodium for such applications as spinnerets for extruding glass fibers. Platinum and platinum-rhodium catalysts, used in the synthesis of sulphuric acid and of nitric acid, have also been in larger demand.

The progress of palladium during the year has been especially remarkable. Recently the public has evidently begun to appreciate the fact that palladium possesses the same handsome color as platinum and is also highly resistant to corrosion and tarnish. This recognition has resulted in its greater use in jewelry.

Use of palladium leaf also is steadily expanding. A novel application during the year was as trim for the large metal and glass chandelier and the sweeping lighting fixtures in the Iridium Room of the Hotel St. Regis. Others were for signs and also for the striping and lettering on the New York Central Railroad's new train, the "MERCURY," and as a surface for the ceiling in the Metal Institute Room of the Federal Warehouse in Washington, D. C. The employment of palladium leaf for lettering and ornamenting fine book bindings and for architectural decoration in general is definitely growing.

Jewelers have used rather large amounts of palladium during the year for rings where the effectiveness of its white color in combination with yellow golds has been outstanding.

Popularity of rhodium plating or so-called "rhodanizing" for silverware has increased markedly.

Iridium has shared in the improvement which has marked all platinum metals, as is evidenced by the fact that the price rose from $55 to approximately $175 during the period of heavy demand. This was due in the main to improvement in the jewelry industry, since jewelers consider a 10 per cent addition of iridium practically essential to harden platinum for their purposes.

SILVER

By G. H. NIEMEYER

Vice President, Handy & Harman, New York

GENERALLY, 1936 was a quiet and uneventful year for silver, a condition which is reflected by the unusually narrow fluctuations in its price. It had a spread of only 5c per ounce during the year, the highest price being quoted January 2nd at 49¾c and the lowest quotation of 44¾c carried through most of the year.

Production figures available indicate that the world produced approximately 253,000,000 ounces of new silver, an increase of about 16% over 1935. All of the silver producing countries showed increases. The highest rate of increase was in South America, where the production went up 34%. The United States mined about 64,000,000 ounces, an increase of 32% over the year previous

It is estimated that our Government purchased about 380,000,000 ounces of silver during 1936. Of this amount approximately 63,000,000 ounces was produced in the United States. Our Government bought most of the newly mined silver produced in Canada, Mexico and South America, and also

made several important purchases from the Chinese Government. It is estimated that the silver holdings of the United States Government total 1,900,000,000 ounces.

While the United States Government was the main support of the market, it is interesting to record that India was an important buyer of silver, the Indian demand for the year totaling approximately 100,000,000 ounces. China, as has already been indicated, continued as a seller of silver and the only other demand, aside from the silver used in Art and Industry, was something over 16,000,000 ounces which went into coinage, largely for Cuba.

During the first six months of 1936 less silver was consumed in the Arts and Industries than the same period of 1935. However, there was a marked improvement in the last half of the year. We estimate consumption in the United States and Canada for the full year 1936 to have been 26,500 ounces or 3,000,000 ounces more than in 1935, an increase for the year of nearly 15%. Consumption in both sterling silver and silver plated ware increased about 15% and jewelry showed a gain of 25%. There was increased use in the motion picture industry of about 5%.

The use of silver in general industry for electrical contacts, brazing, chemical and food containers, etc., again increased, rising about 15% over 1935. General improvement in industry at large and continued research in the development of improved silver products and methods of application indicate continued growth in the use of silver in these fields. The use of silver for electrical contacts has increased tremendously. Considerable progress has been made in the production of bi-metals combining silver with steel, nickel and other metals, which is opening up new fields of use, and the creation of powdered metal combinations incorporating silver with other elements promises interesting developments.

SCRAP AND SECONDARY METALS

By THOMAS A. WRIGHT

Technical Director, Lucius Pitkin, Inc., New York.

SCRAP metal production, to the extent that it is dependent upon general industrial activities, has naturally reflected the marked improvement in business conditions. In general, with the exception perhaps of copper where special price considerations come into effect, consumption by foundries and reclaiming plants has kept pace with production. This is particularly true of aluminum where the demand has been far greater than the supply, due in large part to the activities in the automotive industry. Aluminum is bulky material and to that extent does not encourage excess accumulations.

As to aluminum, the largest domestic producer emphasized in a full page advertisement in a recent issue of the Saturday Evening Post that, as to 1934 at least, 64.4 lbs. out of every 100 lbs. purchased during that year by industry was reclaimed from scrap or bought from foreign producers.

Scrap copper has presented a rather mixed situation. Deliveries to the secondary smelters and refiners have not been as large as might be expected. It is quite possible that when the figures come out the lower or smelting grade will show a much larger percentage as well as actual tonnage increase. Ingot makers are said to have a large tonnage on the books uncovered by scrap and the low lead brasses have been in particularly great demand and in fact are at a premium. This is partly due to government purchases, partly to ordinary industrial requirements and, in the last few months in particular, to export demand.

The continued increase in price of copper has been a factor in encouraging dealer holdings for the rise. Added to this, it is quite likely that many dealers would wish to avoid establishing a profit, particularly in the last month or two. Some of these accumulations held over for the latter purpose may come on the market shortly after the first of the year despite the rather prevalent feeling that the rise in copper price will continue for some time.

The year closes, therefore, with export dealers and foundries both competing for No. 1 and No. 2 copper in particular. There seems also to be a tendency for some manufacturers, heretofore consumers of primary copper, to attempt utilization of purchased clean No. 1 copper. Light copper is also, as the year closes, in big demand from foreign purchasers for use in the production of blue vitriol. On the other hand, it has now become possible to ship foundry ashes and skimmings carrying as low as 10% copper to smelters, whereas not so long ago at the low price of copper such material ranging even from 15 to 20% had gone a-begging.

Lead, both soft and hard, has been moving about the same as heretofore in a steady flow, with the secondary smelters able to sell more than they can produce. Prices have been far from high on battery lead, yet dissatisfaction with returns expressed by the dealers up until a year or two ago appears to have largely evaporated.

In tin alloys and drosses the situation has been somewhat complex with domestic buyers in keen competition for the cream of the crop. Considerable research is going on in this strategic material looking forward to more economical and extensive recovery and even purer products, and there appears to be excellent demand and good success in using both reclaimed or refined secondary tin and also electrolytic solder. In fact the reclaimed tin refining processes in one instance have been perfected during the year to the stage where a high grade tin running 99.98% has made its appearance on the market. This tin incidentally carries little or none of several metals commonly associated with primary refined tin.

The tonnage in tin plate scrap is about 10% head of the previous year, but, despite the export restrictions in effect during a portion of the year, exports were reduced only slightly. Production of tin sand or paste from the silk mills has dropped off around a third and, rather curiously, there has been very little competition from abroad and certainly less than usual.

In nickel scrap the market in the early part of the year was rather in favor of local refiners and their customers, whereas, beginning with the early Fall, Europe took the lead. Stocks on hand at the close of the year are not large, although some accumulations are being held until after the turn of the year. Nickel scrap has presented the anomaly of selling at a higher price than new metal because of the export demands, but the latest word is that domestic buyers are paying higher than Europe is prepared to offer. Some dealers feel that the great part of their export business is gone and that the price abroad may be reduced shortly as there seems to be no ready market for a lot of high grade scrap. Heretofore, it has been going to Germany, Italy, France and England, but Italy seems to be out of the market because of lessened needs and Germany out as far as direct shipments from the U. S. A. because of an unfavorable trade balance, although it is thought that considerable of what little has gone to England has found its way to Germany and there have been some shipments to France as well.

No doubt the war clouds abroad have had a large part in the nickel as well as the copper situation.

Zinc scrap, galvanizers, drosses etc.

seem to require no special comment.

Altogether, the year has probably been a successful one for the dealers in scrap metals, but many faces prominent before the depression are missing, though the breakup of some formerly well known organizations has in certain instances considerably increased competition locally.

The year closes with most dealers in an optimistic frame of mind and with the secondary copper smelters and refiners able and willing to handle much larger tonnages.

Metal Market Review

December 31, 1936.

Copper closed the previous month at 10.50c per pound electrolytic, with foreign metal consistently from a quarter of a cent to a half cent higher. In spite of the reluctance of American producers to raise the price, they were forced to do so because of the drain on their metal, primary and scrap, for export. Consequently, about the middle of the month the price was advanced to 11 cents, then on December 22nd, to 11.625 and again on December 31 to 12c.

Domestic sales for the month of November totalled 88,178 tons, and in December were about 113,000 tons. Domestic consumption is said to be running at about 75,000 to 80,000 a month. This indicates that stocks will begin to increase shortly as production, which is now at about 70,000 tons a month and increasing, catches up with the demand. At the present time, however, there is a decidedly thin market for metal and premiums are reported to have been paid for quick delivery. Speculation in copper in Europe varies from week to week, but is still very active and the American price seems to be dependent largely upon the European figure. American stocks in November were reduced by 17,087 tons.

Zinc, which rose to 5.05c per pound prime western E. St. Louis in November, became extremely firm abroad, due to the improved statistical position. About the middle of December, the price was advanced 10 points to 5.15 and then continued upward rapidly to 5.45, with some metal being sold at a premium for second quarter delivery.

November statistics showed that stocks had been reduced to 45,829 tons of the common grades and 11,698 tons of the high grade metal. Unfilled orders up to December 26, 73,882 tons. Prospects decidedly strong.

Tin which was the beneficiary of a considerable improvement in November continued to be active at 51 to 52 cents per pound Straits. In spite of the announcement of the Tin Committee that production quotas for the first quarter were fixed at 100 per cent of the standard tonnages, the market remained firm. Later in December it was announced that Siam had approved the terms of the new tin control plan and the market became quieter within narrow limits. The price which has risen to 52.25 reacted to 51.05 on December 30th.

Lead was another active and determined performer. After closing November at 5.05 E. St. Louis, sales continued large for the first week and even though later they slowed down slightly, the market remained strong. During the middle of the month, a spurt occurred with the price advancing to 5.40, and then during the following week in successive steps to 5.85c where it rounded out the month.

Sales weekly were 7,000 tons, 4,650 tons, 4,900 tons, 10,000 tons, 9,500 tons and 5,000 tons making a total of 41,050 tons. The monthly rate of absorption is now about 50,000 tons. Stocks were reduced by 6,516 tons in November.

Silver reverted to its former condition of steadiness and quietude. Some speculation occurred in London but without much effect on prices which teetered between 44⅞ and 46 cents per ounce, closing the month at 45¼. Prospects quiet.

Platinum spent the month resting after its dizzy descent during the past two months. The market was quiet and easy and the price from $45 to $48 per ounce. The excitement seems to be over for the present.

Scrap Metals, needless to say, were directly affected by the excitement in primary materials. In addition, scrap copper had to contend with the higher prices for export. Another strange anomaly is that nickel scrap sells at a higher figure for export than primary nickel for domestic consumption.

Prices for scrap material in all lines moved up fairly steadily to keep abreast of the primary market and the export quotations. Ingot metals were advanced under the same circumstances.

The Non-Ferrous Ingot Metal Institute released some interesting figures of the combined unfilled orders as gathered from its previous records month by month beginning February 1, 1934. The record shows a decline from 15,959 tons on that date down to 8,506 tons on January 1, 1935 and then a fluctuating rise back to 18,739 tons on January 1, 1936.

Non-Ferrous Ingot Metal Institute reports the average prices per pound received by its membership on Commercial Grades of six principal mixtures of ingot Brass during the twenty-eight day period ending November 27.

80-10-10 (1½% Imp.)	11.741c
78% Metal	9.652c
81% Metal	9.747c
83% Metal	10.031c
85% Metal	10.228c
No. 1 Yellow Brass	8.345c

During the 28-day period ending December 26:

80-10-10 (1½% Imp.)	12.799c
78% Metal	10.060c
81% Metal	10.458c
83% Metal	10.638c
85% Metal	11.002c
No. 1 Yellow Brass	8.990c

On December 1, unfilled orders for brass and bronze ingots and billets on the books of the members amounted to a total of 30,436 net tons.

The combined deliveries of brass and bronze ingots and billets by the members for the month of November, 1936, amounted to a total of 7,773 tons.

The **Wrought Metal Market** has been more active than at any period since the boom times of 1929. It is estimated by B. B. Caddle, secretary of the Copper & Brass Research Association that the consumption of brass pipe and tubing will approximate 15,000,000 pounds more than in any previous year in the history of the industry. Copper and brass fabricators are running at about 95 per cent capacity. Cable manufacturers are operating at from 50 to 60 per cent capacity. The demand for brass mill products is particularly strong from the building trades for replacement purposes, from the mechanical refrigerator manufacturers, from the automobile industry, which is still one of the largest consumers and from the electrical appliance industry. The electric power industry has not yet come into the market in a big way, and the prospects for the brass and copper industry, when this demand does come, as it must, are decidedly bright.

A large distributor in the Metropolitan Area estimates December business about 8 per cent under November and about 40 per cent over December 1935. The year 1936 will total about 30 per cent more than 1935.

AVERAGE PRICES FOR METALS

	Nov.	Dec.
Copper c/lb. Duty 4c/lb.		
Lake (del. Producers' Price)	10.494	11.06
Electrolytic (del. Conn. Producers' Price)	10.432	10.99
Casting (f.o.b. ref.)	10.078	10.64
Zinc, (f.o.b. E. St. Louis) c/lb. Duty 1¾ c/lb.		
Prime Western (for Brass Special add 0.05)	4.983	5.28
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	51.307	51.85
Lead (f.o.b. St. L.) c/lb. Duty 2½ c/lb.	4.964	5.40
Aluminum c/lb. Duty 4 c/lb.	20.500	20.50
Nickel c/lb. Duty 3c lb. Electrolytic 99.9%	35.00	35.00
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	12.50	12.93
Silver c/oz. Troy, Duty Free	45.431	45.35
Platinum $/oz. Troy, Duty Free	46.50	46.50
Gold — Official U. S. Treasury Price $/oz. Troy	35.00	35.00

Metal Prices, January 7, 1937

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 12.125, Electrolytic, 12.00, Casting, 11.625.
Zinc: Prime Western, 5.45. Brass Special, 5.55.
Tin: Straits 51.35.
Lead: 5.85. **Aluminum,** 19-22. **Antimony,** 14.00.
Nickel: Shot, 36. Elec., 35.

Quicksilver: Flasks, 75 lbs., $95. **Bismuth,** $1.00. **Cadmium,** 75c to $1.05. **Silver,** Troy oz., official price, N. Y., Jan. 8, 45.25c. **Gold:** Oz. Troy, Official U. S. Treasury price, Oct. 27, $35.00. **Scrap Gold,** 6¾c. per pennyweight per karat, dealers' quotation. **Platinum,** oz. Troy, $48.00.

Duties: Copper, 4c lb.; zinc, 1¼c. lb.; tin, free, lead, 2¼c. lb.; aluminum, 4c lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	Duty	U. S. Import Tax*
No. 1 Yellow Brass	10.00	None	4c.lb.[1]
85-5-5-5	12.625	None	4c. lb.[1]
88-10-2	16.625	None	4c. lb.[1]
80-10-10	14.375	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	12.00	None	4c. lb.[1]
Aluminum Bronze	16.25	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	14.00	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	16.25	20% a. v.	4c. lb.[1]
No. 12 Aluminum	19-25	4c. lb.	None
Manganese Copper, Grade A (30%)	21-27	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	15-17	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	16-18	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	20-32	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	57-75	None	None
Iridium Platinum, 5% (Nominal)	$52.00	None	None
Iridium Platinum, 10% (Nominal)	$56.00	None	None

* Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed.	9⅜to 9⅝	Free	4c. per pound on copper content
Light copper	8½to 8⅝	Free	
Heavy yellow brass	6 to 6¼	Free	
Light brass	5⅝to 5¾	Free	
No. 1 composition	8½ to8⅝	Free	
Composition turnings	8¼to 8⅜	Free	
Heavy soft lead	5⅛to 5¼	2⅛c.lb.	None
Old zinc	3 to 3¼	1½c.lb.	
New zinc clips	4 to 4¼	1½c.lb.	
Aluminum clips (new, soft)	14 to14¼	4c.lb.	
Scrap aluminum, cast	12¼to12½	4c.lb.	
Aluminum borings—turnings	6 to 6¼	4c.lb.	
No. 1 pewter	36 to 37	Free	
Electrotype	5¼to 5½	2⅛c.lb.*	
Nickel anodes	24 to 25	10%	
Nickel clips, new	33 to 35	10%	
Monel scrap	8½to 15	10%av.	

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since December 31, 1936. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	19⅜c.	2½c. lb.
Bare wire, soft, less than carloads	16⅛c.	25% a. v.
Seamless tubing	20⅜c.	7c. lb.

* Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	27 c.	10% Quality	29⅝c.
15% Quality	29⅛c.	15% Quality	34 c.
18% Quality	30⅜c.	18% Quality	37¼c.

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	
Sheet	17¼c.	18¼c.	19¼	4c. lb.	U. S. Import Tax 4c. lb. on copper content.
Wire	17½c.	18½c.	19½	25%	
Rod	15¼c.	18½c.	19⅜	4c. lb.	
Angles, channels.	25 c.	26¼c.	27	12c. lb.	
Seamless tubing.	20 c.	20¾c.	21¾	8c. lb.	
Open seam tubing	25 c.	26¼c.	27	20% a.v.	

TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.	
Tobin Bronze Rod	19⅛c.
Muntz or Yellow Rectangular and other sheathing	20½c.
Muntz or Yellow Metal Rod	16⅝c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.80
Aluminum coils, 24 ga., base price, ton lots, per lb.	30.50

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	49c.	Cold Rolled Sheet	53c.
Hot Rolled Rods	44c.	Standard Sheet	48c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	34	Standard Sheets (base)	38
Cold Drawn Rods (base)	39	Cold Rolled Sheets (base)	43

SILVER SHEET

Rolled sterling silver (Jan. 8) 47¼c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	10.00	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	10.75	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	14.75	2c. lb.
Full Lead Sheet (base price)	9.25	2¾c. lb.
Cut Lead Sheet (base price)	9.50	2⅜c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 50.

Pig Iron and Metal Production of the United States

Calendar Years 1927-1935. (1936 Estimated)

(Figures Through 1935 from the United States Bureau of Mines)

PRODUCTS METALLIC	1927 Quantity	1927 Value	1928 Quantity	1928 Value	1929 Quantity	1929 Value	Products
Pig iron (spot value), long tons	34,866,644	$646,226,139	38,303,699	$661,351,270	41,549,161	$731,858,075	Pig iron
Copper, sales value, pounds	1,684,040,983	220,609,000	1,825,900,393	262,930,000	2,002,863,135	352,504,000	Copper
Zinc, sales value, short tons	576,960	73,851,000	591,525	72,166,000	612,136	80,802,000	Zinc
Tin, short tons	27	34,600	47	47,400	39	35,600	Tin
Lead (ref.) sales value, short tons	668,320	84,208,000	626,202	72,639,000	672,498	84,735,000	Lead
Aluminum, pounds	160,000,000	39,266,000	210,000,000	47,899,000	225,000,000	51,864,000	Aluminum
Nickel, value at New York, short tons	860	390,740	522	291,836	340	297,273	Nickel
Quicksilver, value at N. Y., flasks (e)	11,276	1,314,782	17,870	2,207,003	23,682	2,892,638	Quicksilver
Silver, commercial value, troy ounces.	60,434,441	34,266,328	58,462,507	34,200,567	61,327,868	32,687,754	Silver
Gold, coining value, troy ounces	2,197,125	45,418,600	2,233,251	46,165,400	2,208,386	45,651,400	Gold
Platinum and allied metals, value at New York City, in troy ounces	46,050	3,780,216	59,039	4,692,786	47,977	3,121,471	Platinum
Total value of metallic products (approximate) (b)		$1,217,000,000		$1,284,580,000		$1,475,990,000	

PRODUCTS METALLIC	1930 Quantity	1930 Value	1931 Quantity	1931 Value	1932 Quantity	1932 Value	Products
Pig iron (spot value), long tons	29,905,355	$512,165,131	17,812,579	$285,147,156	8,518,400	$126,032,714	Pig iron
Copper, sales value, pounds	1,394,389,327	181,271,000	1,042,711,178	94,887,000	544,009,948	34,273,000	Copper
Zinc, sales value, short tons	489,361	46,979,000	291,996	22,192,000	207,148	12,429,000	Zinc
Tin, short tons	17	10,500	4.1	2,050	0.5	220	Tin
Lead (ref.) sales value, short tons	573,740	57,374,000	390,260	28,879,000	255,337	15,320,000	Lead
Aluminum, pounds	229,035,000	50,961,000	177,544,000	37,284,000	104,885,000	20,453,000	Aluminum
Nickel, value at New York, short tons	308	213,803	373	202,406	195	88,515	Nickel
Quicksilver, value at N. Y., flasks (e)	21,533	2,478,789	24,947	2,179,145	12,622	731,129	Quicksilver
Silver, commercial value, troy ounces.	50,748,127	19,538,029	30,932,050	8,970,294	23,980,773	6,762,578	Silver
Gold, coining value, troy ounces	2,285,603	47,247,600	2,395,878	49,527,200	2,449,032	50,626,000	Gold
Platinum and allied metals, value at New York City, in troy ounces	43,502	2,048,824	36,205	*1,274,029	17,616	592,000	Platinum
Total value of metallic products (approximate) (b)		$982,550,000		$567,200,000		$283,700,000	

PRODUCTS METALLIC	1933 Quantity	1933 Value	1934 Quantity	1934 Value	1935 Quantity	1935 Value	Products
Pig iron (spot value), long tons	14,353,197	$213,347,583	15,626,192	$261,399,963	21,178,353	$358,145,499	Pig iron
Copper, sales value, pounds	449,999,143	28,800,000	488,454,107	39,076,000	762,587,340	63,295,000	Copper
Zinc, sales value, short tons	306,010	25,705,000	355,366	30,561,000	412,184	36,272,000	Zinc
Tin, short tons	3.0	2,400	9.2	9,600	49.8	50,200	Tin
Lead (ref.) sales value, short tons	259,616	19,212,000	299,841	22,188,000	310,505	24,840,000	Lead
Aluminum, pounds	85,126,000	16,174,000	74,177,000	14,094,000	119,295,000	22,070,000	Aluminum
Nickel, value at New York, short tons	126	62,913	157	108,414	160	129,500	Nickel
Quicksilver, value at N. Y., flasks (e)	9,669	572,666	15,445	1,140,845	17,518	1,261,121	Quicksilver
Silver, commercial value, troy ounces.	23,002,629	8,050,920§	32,725,353	21,155,784*	45,924,454	33,008,201	Silver
Gold, coining value, troy ounces	2,556,246	52,842,300‡	3,091,183	108,191,400**	3,609,000	324,900	Gold
Platinum and allied metals, value at New York City, in troy ounces	51,539	1,631,000	47,274	1,686,000	42,060	1,414,000	Platinum
Total value of metallic products (approximate) (b)		$411,300,000		$543,500,000		$721,600,000	

ESTIMATES OF UNITED STATES PRODUCTION FOR 1936[1]

	Quantity	Value Total	Value Per Unit
Pig iron (spot value) long tons (Iron Age)	30,618,797	$578,695,263	$18.90
Copper, pounds	1,484,000,000	142,464,000	9.6c
Zinc, pounds	1,048,600,000	51,391,886	4.901c
Tin (U. S. deliveries) pounds	165,771,200	76,985,803	46.441c
Lead (pig), sales value, pounds	918,000,000	.....	4.56c
Silver, troy ounces, net price paid to producers	61,750,000	41,850,800	.77c
Gold, troy ounces	4,300,000	150,500,000	$35.00

(a) Composite average; used as basis of total output value also.
(b) Includes some items of minor interest to metal trades not shown in table. (c) Del. Conn. Valley. (d) E. St. Louis.
(e) For years 1920 to 1927, inclusive, mercury reported by the Bureau of Mines in flasks of 75 pounds; for 1928 and succeeding years, in flasks of 76 pounds.
(f) No longer calculated separately. (g) Spot Straits average.
* At 65 + cents per fine oz.
** At $35 per fine oz.
§Average value 35c. per oz.
‡At $20.67 per ounce. Average weighted value for 1933 was $26.56 per oz.
[1] From Engineering & Mining Journal.

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